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**Id: 77356846**

**LBU Student**

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Module leader: Mr. Rohit Raj Pandey

Module Supervisor: Mr. Rohit Raj Pandey

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## Final Year Project 2025



### Smart Vitals A Portable Health Monitoring System

Submitted by  
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## **Abstract**

In todays' modern technologically driven world, Smart Vitals presents itself as an IoT enabled, multifunctional and portable device for health tracking. Designed to provide users with an affordable solution replacing traditional tools, it allows people to get insights on their health and surroundings with a single device. The main focus of developing this device is to make health readings accessible to people wherever they are. It not only saves valuable time of the users but also allows them to take preventive measures. Smart Vitals aims to promote health sector as it provides all-in-one solution for monitoring basic vitals. While Smart Vitals is still a prototype, with further enhancement, proper research and refining, it has a promising scope.

### **Student Declaration**

Through this declaration, I confirm that "Smart Vitals: A Portable Health Monitoring System" project is the outcome of my individual work, which had been executed under the mentorship of Mr. Rohit Raj Pandey, Project Supervisor as per requirements of Bachelor's degree in Computer Science.

Furthermore, I declare this project is completely the result of my independent work and that the project has not been handed in at any other institution.

A handwritten signature in black ink, appearing to read "Soya Shrestha".

Soya Shrestha

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Level 6 BSc. Computing

The British College

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## List of Abbreviations / Acronyms

Abbreviations	Explanation
ECG	Electrocardiogram
OLED	Organic Light Emitting Diode
IoT	Internet of Things
LCD	Liquid Crystal Display
GPIO	General Purpose Input/Output
MAX30102	Maxim Integrated Pulse Oximeter and Heart Rate Sensor
RAD	Rapid Application Development
ESP	Espressif Systems
I2C	Inter-Integrated Circuit
GPS	Global Positioning System
DHT22	Digital Humidity and Temperature Sensor
SDA	Serial Data Line
SCL	Serial Clock Line
RX	Receive (Receiving Pin)
TX	Transmit (Transmitting Pin)

## **CHAPTER 1: INTRODUCTION**

Smart Vital is a portable health monitoring device. It is designed to measure vital signs of an individual. It includes Sp<sub>0</sub><sub>2</sub> level, heart rate, ECG, temperature, and blood pressure measurement by utilizing embedded system and IoT. The device provides easy and quick access to essential health parameters in real-time through locally as well as through mobile application. The main purpose for the development of the device is to facilitate users with a reliable and user-friendly product for the healthcare management system.

The device is developed so that it can be placed at first aid or medical box at home or it can be used while travelling as it is compact and easy to carry. A single compact device is used unlike having different devices for measuring health vitals. It offering all in one general health measurement, making sure that you have all the necessary health information well within access whether you are on the go or at home. The device Smart Vitals fulfils the increase in the need and demand of the health care system as it is portable and convenient to use. The system uses ESP32 WROVER as microcontroller, which is the main processing segment for collecting the data from sensors like Max30100, AD8232, 10K NTC Thermistor temperature sensor. The readings from the sensor are locally access via OLED display and also transmitted to mobile application made via Flutter. If there is any abnormality in the reading, alert is sent, ensuring timely intervention.

Smart Vitals was compared with various existing products, during which the uniqueness of the smart vitals was discovered. Additionally, the key features of the smart vitals were also highlighted. All the hardware and software components were well-identified, even the smallest of the components. Without the use of those components the working of smart vitals would lack behind. Smart Vitals followed the agile methodology for its development as it allows flexibility and phased development. The product design includes the overall flow of the system as well as the flow of users interacts with the device and system. The features of smartvitals with the level of priority was emphasized. After the product was developed, the product was tested continuously finalizing the products'

evaluation ensuring that the system passed every test for both device and mobile application. MS Project was utilized to keep track of the progress of the project with proper planned layout, while GitHub was used for version control and to keep track of the changes made in the project. Similarly, ERD was used to get knowledge on the data structure and better understanding of the database model. At last, the overall project summary and outcome was discussed, including the performance of the system and how the system could be further enhanced for future works.

## **CHAPTER 2: REVIEW OF LITERATURE**

The continuous advancement in technologies in health care has led to advanced approaches like Smart Vitals. The importance of products like Smart Vitals has emerged as a necessary device in healthcare and management due to the rapid global interest for its portability and remote health monitoring features. The incorporation of IoT and micro-controller enable the device to provide users with essential health vitals giving a proper and prompt insights into a person's health state providing assurance to the user. By gaining knowledge on personal health, it allows users to take an active part in maintaining their health and taking precautions as needed. As the device has features such as being portable and remotely accessibility, it makes devices like Smart Vitals to be effective and beneficial for any individual to keep track of their health, even on the areas with insufficient healthcare facilities. Not only that it provides vitals information through mobile application as well, making it easier for the users to keep track of their health.

Smart Vitals: A Portable Health Monitoring System, summarizes the importance of compact device, high-tech health monitoring system via advanced technology. It focuses on device's intelligence, accessibility with user friendly components making it advanced, accurate and efficient health measuring system made to

achieve present days' requirements. The device helps to tackle obstacles related to healthcare management by allowing users to view their real time health vitals. One of the major benefits is the ability to minimize the need for medical visits for regular health check-ups, reducing expense and saving time. In todays' modern market, people are more inclined towards smart healthcare system including wearable technologies, Smart Vital distinguishes itself by presenting value for money, live tracking, and mobile application integration.

The "Android Based Health Parameter Monitoring" by (Trivedi & Cheeran , 2017) has embedded system with Android mobile app that tracks and keeps record of vital heath signs which includes body temperature and heart rate via sensors and transmits data via Bluetooth to mobile app. While Smart Vitals offers wide range of health parameters for monitoring including ECG, blood pressure and SpO<sub>2</sub> level. The data transmission is real-time based and quick in the mobile application via Wi-Fi connection. The mobile application developed by (Trivedi & Cheeran , 2017) is very minimal delivering limited user interaction, with basic display of readings. In comparison, Smart Vital offers more user engagement with visual analytics. The system has dashboard which allows users to view detailed data trends, elevating user experience allowing the app to be user-friendly and helpful.

According to (Varghese & Muthukumaraswamy, 2025)'s "An IoT-Based Health Monitoring System for Elderly Patients", health care has been lacking behind a lot due to growth in elderly population in China, which is the reason for the development of remote health monitoring device. The device includes components for measuring pulse rate, blood pressure, temperature and oxygen saturation and Arduino as the core processing unit. Although the system by (Varghese & Muthukumaraswamy, 2025) offers most of what Smart Vitals offers, the system does not contain mobile application which is somewhat a necessary part as it allows users to view data anywhere with Wi-Fi connection. Smart Vital offers a feature to send alert such as voice alert through the mobile application and via Email as well with device location to the users for any irregularity in the

reading, which allows users to take precautions to make sure they are maintaining their health status, which is lacking in the “An IoT-Based Health Monitoring System for Elderly Patients” research paper. The need for alert message is crucial as the system focuses on elderly patients who are more vulnerable to health issues.

“Development of Blood Oxygen Level, Heart Rate And Temperature Monitoring System by Using ESP32” system developed by (Ahmad, et al., 2022) has presented their system using ESP32 integrated with MAX30102 and MLX90614 for SpO<sub>2</sub>, Beat Per Minute (BPM) and body temperature respectively, which will then be displayed on the android application. The ESP used in the development of the system is powered by using LIPO rechargeable battery via charger module. ESP 32 WROVER B used in the Smart Vital project has a built-in battery holder which can power the microcontroller without the need for extra components or modules. The results can be monitored on the Serial Monitor of Arduino IDE and via cloud system. One of the biggest drawbacks of the system I think is not using a remote tool for displaying data, additionally not including mobile application. Smart Vital project contains both OLED display and mobile application for user convenience. The accuracy rate of 95% for temperature, can be improved by using sensor such as per (Sari, et al., 2021), an accuracy of 99% was achieved with right calibration. Similarly, 10K NTC thermistor thermometer sensor was used in Smart Vitals which gives more accurate reading when calibration is done right. (Ahmad, et al., 2022) has stated in their research paper on how the system can be further improved, by adding blood pressure measurements, which is implemented in Smart Vitals project.

(Sheikh , et al., 2024) has delivered a simple system in “Analysis of Patient Health Using Arduino and Monitoring System” for measuring vital signs such as temperature, heart rate and blood oxygen level, processing data via Arduino. While making any device which includes crucial data it is important for the developers to choose the components wisely specially health monitoring system.

The study carried out by (Hosan, et al., 2025) concluded that ESP is reliable as it performs much better in comparison to Arduino while performing sophisticated tasks. “Analysis of Patient Health Using Arduino and Monitoring System” does not focus on development of mobile application, only the use of LCD is seen. Smart Vitals has mobile application which allows users to explore different features. (Sheikh , et al., 2024) has stated in their journal about inaccurate readings and less IoT features. It is essential to have nearly precise reading while developing such system so that users can have assurance and can take precautions accordingly.

## CHAPTER 3: REVIEW OF TECHNOLOGY

Different tools, technology and components were used in the project during the development of Smart Vitals which are listed below:

### 3.1 Hardware Components

1. **ESP 32 WROVER TYPE B** is a micro-controller; it has powerful ability to process data with built-in Wi-Fi and battery holder with many GPIO pins which was the reason for its usage.

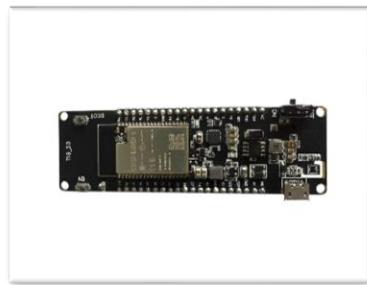


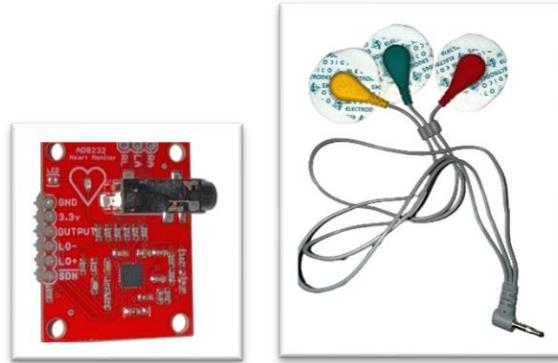
Figure 1: ESP 32 WROVER TYPE B

2. **MAX30102 sensor** uses photoplethysmography (PPG) which was used to measure the heart rate, SpO<sub>2</sub> and an estimated blood pressure.



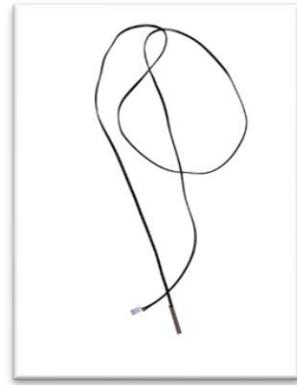
*Figure 2: MAX30102 sensor*

3. **AD8232** is a device to measure ECG signal. It was used as it gives optimal ECG signal measurement.



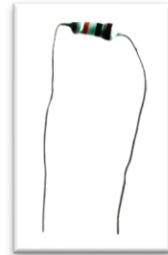
*Figure 3: AD8232 sensor*

4. **10K NTC Thermistor temperature sensor** is used for measuring body temperature. Its resistance lowers while temperature is increased, making it suitable for accurate temperature measurement.



*Figure 4: 10K NTC Thermistor temperature sensor*

5. **10 K Resistor** is electrical component which controls voltage and limit current. It ensured the components receive proper voltage and current supply. It was used in the 10 K NTC thermistor thermometer sensor.



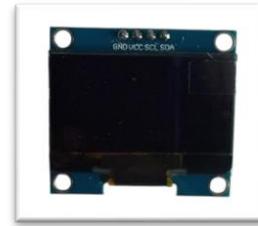
*Figure 5: 10 K Resistor*

6. **Push Button** is electromechanical switch, allowing manual control of the circuit. It was implemented to switch the sensors measurement as per requirement.



*Figure 6: Push Button*

7. **OLED** was used for local display of the real-time measurements also displaying necessary messages.



*Figure 7: OLED display (1.3' inch)*

8. **Batteries** were used to provide a common power supply to make sure the micro controller worked properly with all the sensors.



*Figure 8: Li – ion Battery*

9. **MQ-135** was used for air quality monitoring of a particular room, showing different ranges of air quality.



*Figure 9: MQ-135 sensor*

10. **NEO-6M GPS Sensor** was used as it allows users to track the location, which is used as additional layer for safety of an individual to take necessary precautions.



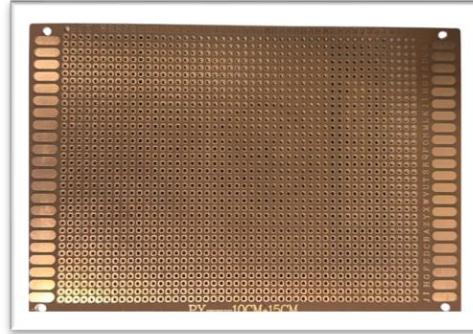
*Figure 10: NEO-6M GPS Sensor*

11. **DHT22 sensor** was used to as it gave the insights on the current room temperature.



*Figure 11: DHT22 sensor*

12. **Matrix Board** was used to integrate all the hardware components with ESP 32 Wrover type B making the connection easier to join and compact.



*Figure 12: Matrix Board*

13. **Soldering items** such as soldering rod and soldering wire, steel wire wool, wax was used to join the wire for fixed connections.



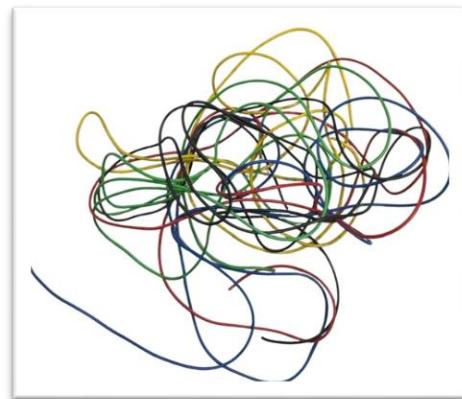
*Figure 13: Soldering iron, wax, wire, steel wire wool*

14. **Glue** was used to join all the components ensuring the connections to work properly and to attach the 3D printed box.



*Figure 14: Hot Glue Gun*

**15. Connection Wire** was used alongside soldering to connect the micro controller with the hardware components.



*Figure 15: Connecting wire*

**16. 3D printing (Creality Ender 3)** was used to make a stable box which fitted all the hardware components which made the project more presentable and easier to carry.



*Figure 16: Creality Ender 3*

17. **Power bank Module** was used to charge the battery via charging cable also to power the system (micro controller and all the hardware components).



*Figure 17: Power bank module*

18. **Reset Button** was used as it allows to reset the ESP, which might come in handy when the system is lagging or when OLED display is not responsive.



*Figure 18: Reset Button*

19. **Type B cable** was used to connect the system with power bank module. It was also used to charge the module.



*Figure 19: Type B cable*

### 3.2 Backend

1. **Firebase** was used as it acts as a secure platform for user authentication and stores users' current health vital information ensuring smooth access to user data. It allows to create collections which was further divided into documents to store user data.

### **3.3 Operating System**

1. **Windows 11** is used as it supports all the software and hardware components for smooth operation of the SmartVitals project.

### **3.4 Language, framework and Libraries**

1. **C/C++** was used as primary programming language as it helps in effective programming and suitable for hardware like ESP32.
2. **Dart** was adopted for development of mobile application.
3. **Flutter** was used for creating responsive UI for real-time data visualization.
4. **ThingSpeak** allowed to visualize, collect and analyze data after integration with microcontroller.
5. **ESP32-SDK** allowed effective development, handle wireless communication and hardware integration.
6. **Wire.h** was used for I2C communication for effective data exchange among ESP32 and components used.
7. **WiFi.h** library was used as it allows Wi-Fi connectivity for IoT devices which helps in data transmission.
8. **SparkFun MAX3010x Library** allowed easy communication with MAX sensor and collect accurate data in real-time.
9. **U8g2** library is common library for graphics display used with microcontrollers to get display in OLED.
10. **Math.h** library was used to carry out mathematical calculations which was essential during calibration and while using different formulas and equations.
11. **TinyGPS++.h** library was used to gather GPS data which helped in getting the location of the device.

12. **DHT.h** library was utilized while gather data from DHT22 sensor for temperature data.
13. **HTTPClient.h** library was used to receive and send data to and from the web server.
14. **HardwareSerial.h** library was used as it allows communication with various serial device using UART ports, which are built-in ports in ESP32.

### 3.5 Version Control

**GitHub** was utilized as version control as it helped to manage the codes and files efficiently and keep track of the project history and encouraged for regular commits. Project progression was also seen through commit history.

### 3.6 Documentation

1. **MS Word** was used to create initial plan, ethical consent form for the project and prepare a thorough report of the project.
2. **MS Project** was used to present a well-constructed workflow of the project for ease development of the project in a structured manner.
3. **MS PowerPoint** was used to deliver presentation which supports the development of the product.

### 3.7 Web Browser

**Google Chrome** was utilized as it is easy to use, offers secure surfing experience and is trusted web browser for debugging and running web portals.

## CHAPTER 4: METHODOLOGY

Agile methodology has been used for Smart Vitals project. Agile method allows scalability and adaptability which enables to handle technical error effortlessly at early stages without interrupting other components. The flexibility, in Agile methodology allows developers to include new features or components in later stages based on the evolving requirements. Constant feedback is provided which ensures the progression of the project to meet the end goal the expectations. Additionally, the agile method offers iterative process enabling to build and improve the project piece by piece rather than following a linear or firm plan.

The Agile process has different stages each stage contributing for the progressive development of the Smart Vitals project. Research and Specification Collection is the first stage where the essential modules like ESP32, MAX30102, SpO<sub>2</sub> sensor, ECG sensor, Temperature sensor, are examined with the help of the datasheets. The next stage is Planning and Circuit Designing where the sensor connections were validated with the help of Wokwi for circuit diagram layout. After the successful circuit design, the main focus was integration of MAX30100, ECG and Temperature sensor with ESP32 for processing sensor data and with OLED for data monitoring. Then, 3D models and PCB design was developed and designed in TinkerCAD during Designing and Prototyping stage. In the Development stage, the microcontroller was programmed to analyze sensor data to communicate wirelessly with the mobile app. After the system being functional, in the Testing phase the product was regularly tested ensuring precision, stability and working of hardware and software components. Lastly, in deployment and maintenance stage, improvement of the product was done where the product was updated based on user feedback.

The waterfall method is a conventional and sequential approach where each stage must conclude before beginning with the next stage following stable workflow used for project that has well-defined end goal. The project Smart Vitals project has different hardware and software integration which needs to be tested continuously for precision and improvement, in waterfall method testing is

conducted following the development stage. Any issue in the project might not be identified until the very end which will be very risky making the process time consuming and complex which is the reason for Agile methodology being used as it offers constant testing and evaluation throughout the product development. RAD focuses on prompt development of the prototypes and user reviews. The Smart Vitals project focuses on providing accurate, dependable and secure data which are essential for health care, RAD focuses on quick deployment which could result in patchy testing and disparity between hardware and software. Therefore, Agile methodology is used as it provides iterative feedback which assures the product is tested thoroughly and reliable medically. The Spiral Model mainly focuses on risk management and developing the project in an iterative manner which can help the developers eliminate or avoid the risks completely during the initial phase. It focuses on thorough reports, planning which is suitable for large-scale project with peak risks which is why agile method is used as it is suitable for small to medium scale projects like Smart Vital with risks like data reliability which can be avoided with regular evaluation.

## CHAPTER 5: PRODUCT DESIGN

### 5.1 General Overview of the system



*Figure 20: Smart Vitals device*

Smart Vitals system starts the work when the device is turn on via plugging the cable, which activates the micro controller then the OLED display. The OLED asks the user to press the button according to their preference of vital measurement which then activates the sensor, the sensors start taking the reading. The reading via sensor is seen on the OLED display. The user can press the button again to deactivate the reading. Additionally, reset button has been placed which allows the users to reset the system when the system does not response. For charging the battery, Type B cable can be used.

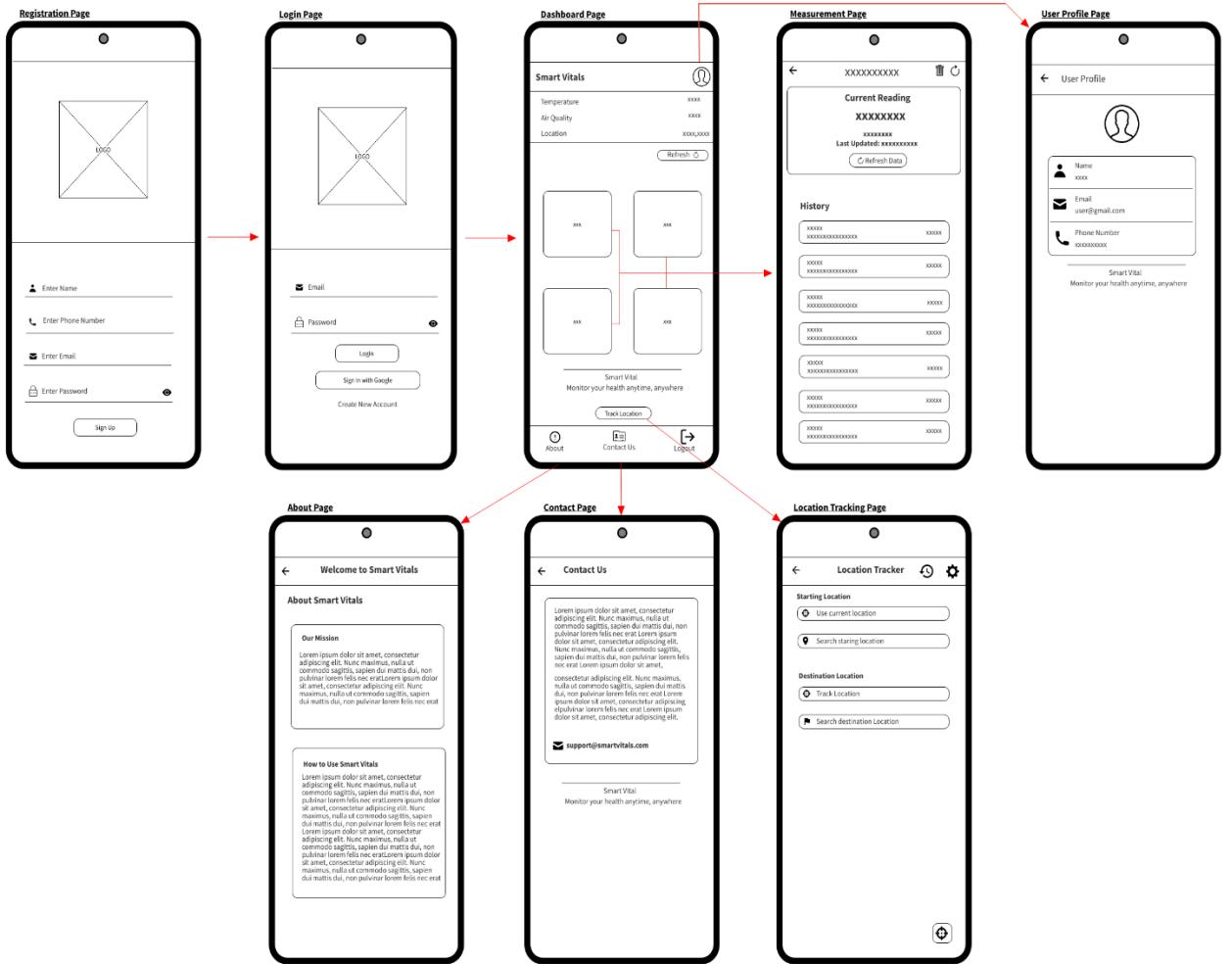


Figure 21: Wireframe for Smart Vitals

When the user logs in on the Smart Vital mobile application, they can get access to their desired reading. If the user is not already registered the user can create a new account with valid credentials to get access to their vital readings. Additionally, the user can also view their vital history. The user can also get access to their profile, get general overview of the Smart Vital, how to use it on about page. The contact us page is also seen on the interface which allows user to get in touch if any queries. The user gets alert like voice alert and mail alerts if there are any abnormalities in the reading.

## 5.2 Data Flow Diagram

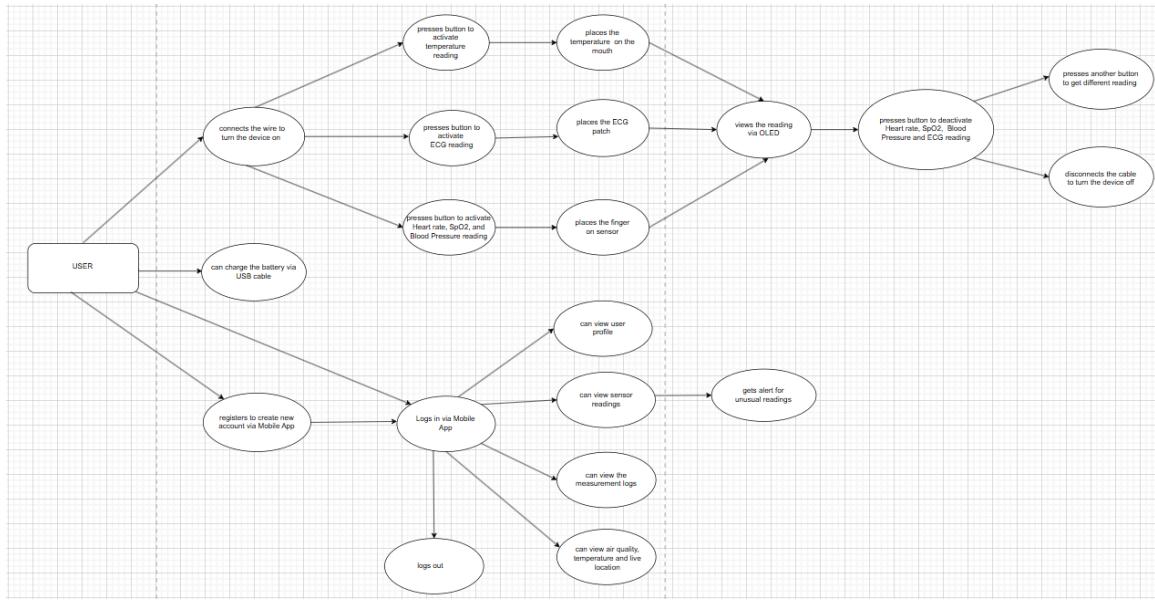


Figure 22: Dataflow diagram for Smart Vitals

Smart Vitals lets users to view their health vitals remotely and via mobile application which allows them to stay on top of their health and take necessary precautions. The smart vital is designed in such a way that the users can easily operate the device. To take any measurement the user first needs to turn on the device via button, which is present on the side. Once the device is turned the user can see the OLED being turned on, asking them for the specific vital they want to measure. The user needs to press the button according to their need of measurement, SpO<sub>2</sub>, Heart rate, Blood Pressure or ECG or body temperature. The system starts taking the reading once user has placed their finger on the sensor for SpO<sub>2</sub>, heart rate and Blood Pressure reading, or placed the patches on for ECG reading or placed the thermometer for temperature reading. The user can view their health readings on the OLED for remote display. Once the reading is done, they can either deactivate the sensor by pressing the button or turn the device off. The user can also charge the battery via USB cable.

Additionally, the user can also register to the mobile application of smart vitals with their credentials or login if they already have an account with their correct

credentials, which will redirect them to the smart vitals' application. The user can view their health vitals via mobile application; all the measurements are separated so that it is easier for user to view the desired readings. They can also view their profile, can check the health measurement history. User can also view about smart vitals page to get information related to device. The user can get insights on the air quality, environment temperature and live location. The user can log out of the system with ease at any moment.

## CHAPTER 6: SOFTWARE REQUIREMENT ANALYSIS

The table below represents the features of the project with its priority listed as HIGH, MEDIUM OR LOW. HIGH being the most important feature, followed by MEDIUM being moderately important and LOW being relatively less important feature of the product.

Features	Priority
The device should be easy to use and portable.	HIGH
Cable for turning the device on and off.	HIGH
The device should connect to stable Wi-Fi connection for flawless communication.	HIGH
Push buttons for switching the readings between the sensors for particular health measurement as per user's desire.	HIGH
Readings from sensors such as MAX30102, 10K NTC Thermistor Thermometer sensor, AD8232.	HIGH
The reading taken via sensor should be displayed on the OLED with appropriate message.	HIGH
The measurements should be shown in the mobile application after being connected to the stable Wi-Fi connection.	HIGH

Voice Alert should be sent to the user if there is any abnormality in the reading.	MEDIUM
Additionally, alert via email is also sent to the user when any abnormal reading is detected with device location.	MEDIUM
The data from the measurements should be logged when user desires.	MEDIUM
The device should be able to charge when connected using USB cable Type B.	MEDIUM
Users can get access to the live location from mobile application when device is turned on and connected to a stable Wi-Fi connection.	MEDIUM
Device location coordinates (latitude and longitude) should be seen on the home page when exposed to open sky.	MEDIUM
User can delete the vitals history whenever they want.	LOW
User can delete their profile as per their desire.	LOW
Additionally, user can view location history.	LOW
Users can get insights on room temperature.	LOW
Air quality monitoring should be seen on the homepage of the mobile application.	LOW
Reset Button should refresh or reload the OLED display.	LOW

*Table 1: Software Requirement Analysis for Smart vitals*

## CHAPTER 7: IMPLEMENTATION AND TESTING

### 7.1 Setting Device

#### 7.1.1 Arduino IDE Board Manager

The esp32 board by Espressif Systems is used as it supports ESP 32 Wrover Module which is the ESP used in the development of the smartvitals project.

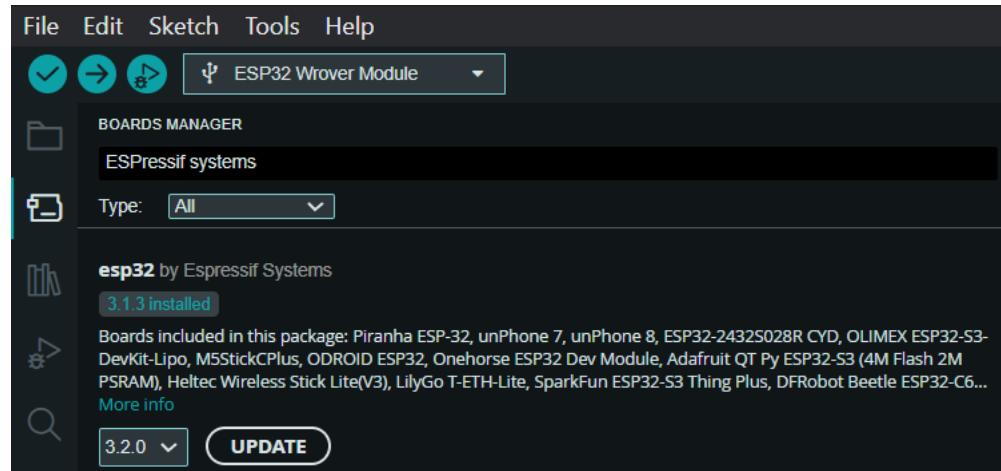


Figure 23: esp32 Board Manager

#### 7.1.2 Arduino IDE Libraries

Different libraries were used for the hardware components for the successful project completion. All the libraries used are listed below:

1. Spark Fun MAX3010X library speeds up the development process and reduces bugs with its predefined functions, which is used to calculate the pulse rate, and SpO2.

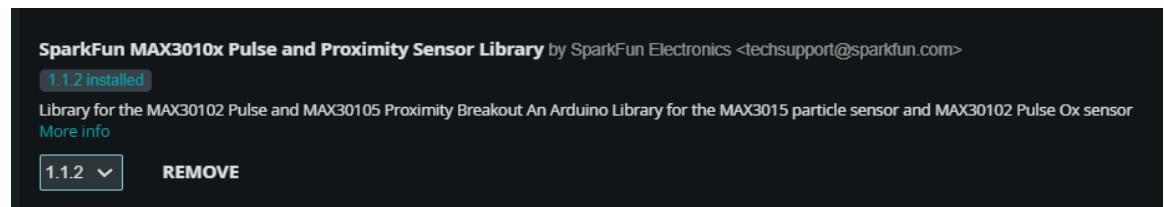
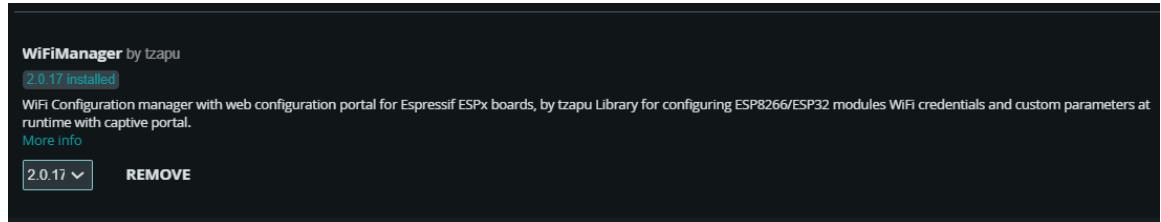


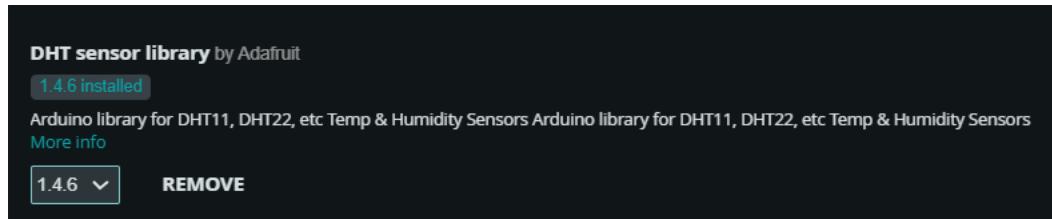
Figure 24: SparkFun Max3010x Pulse and Proximity Sensor Library

2. WiFi Manager library provides a simplified way to get connected with the wifi, creating a portal allowing easy connection when a new network is being used.



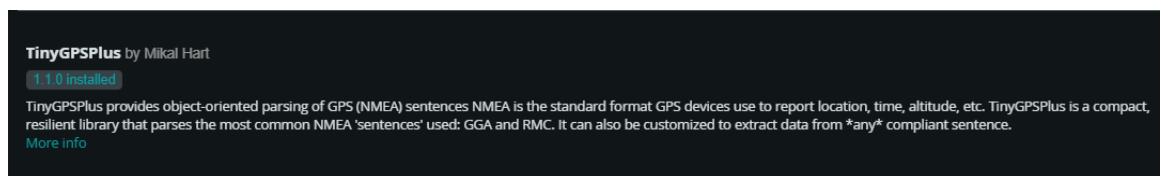
*Figure 25: WiFi Manager Library*

3. DHT sensor library provides a ready to use function such as `readTemperature()` which does the signal reading and timing in the background and gives the value for the temperature.



*Figure 26: DHT sensor Library*

4. TinyGPSPlus library gives a parsed, readable value for longitude and latitude from the raw data coming from the Serial of the GPS without the need for manual decoding.



*Figure 27: TinyGPSPlus Library*

- U8g2 library allows to easy communicate with the OLED, with I2C interfaces with monochrome display.

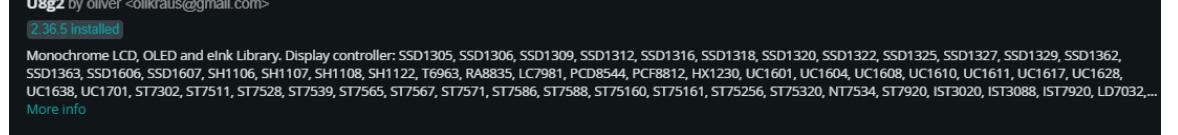


Figure 28: U8g2 Library

### 7.1.2 Pin Configuration

The screenshots below show the pins assigned to each hardware components. For OLED and MAX30102 pins 5 and 18 for SDA and SCL are assigned respectively. Pin 26 for RX and pin 27 for TX is assigned for GPS module.

```
136 // Wire.begin(5, 18); // SDA, SCL for OLED/MAX30102
137
138 gpsSerial.begin(9600, SERIAL_8N1, 26, 27); // GPS Module: Baud, Format, RX, TX
139
```

For ECG output, pin 33 is assigned, for thermistor pin 34 is assigned similarly pin 4 and pin 35 is assigned for analog read for DHT22 and MQ-135 sensors respectively.

```
35 // ECG
36 #define ECG_PIN 33
37
38 // Thermistor configuration
39 #define SENSOR_PIN 34
40
41 // DHT sensor for temperature
42 #define DHT_PIN 4
43
44 // MQ-135 sensor for air quality
45 #define MQ135_PIN 35
```

Three pins 12, 14 and 15 are assigned for buttons to operate MAX30102, ECG and Thermistor sensor correspondingly, which when clicked should activates the sensors.

```
25 // Button pins
26 #define BUTTON1_PIN 12 // MAX30102
27 #define BUTTON2_PIN 14 // ECG
28 #define BUTTON3_PIN 15 // Thermistor
```

### 7.1.3 WIFI Configuration

The code below starts a WIFI portal with “Smart Vitals” as its name which allows users to set up the network. Then it confirms if micro controller is connected before transmitting to the API.

```
120
121 WiFiManager wifiManager;
122 Serial.println("Starting Wi-Fi Manager...");
123 wifiManager.autoConnect("Smart Vitals");
124

97 if (WiFi.status() == WL_CONNECTED) {
98   HTTPClient http;
99   http.begin(url);
100  int httpCode = http.GET();
101
102  http.end();
103 } else {
104   Serial.println("WiFi not connected.");
105 }
106 }
```

### 7.1.4 OLED Display with Feedback

The code snippet below shows how the OLED displays messages according to users’ actions, when the system starts the choice for pressing the buttons are seen.

```
150
151 u8g2.clearBuffer();
152 u8g2.setFont(u8g2_font_ncenB08_tr);
153 u8g2.drawStr(3, 12, "Smart Vitals Ready");
154 u8g2.drawStr(3, 28, "Btn1: HR/SpO2/BP");
155 u8g2.drawStr(3, 44, "Btn2: ECG");
156 u8g2.drawStr(3, 60, "Btn3: Temperature");
157 u8g2.sendBuffer();
158 }
```

When button one is pressed once it displays, “MAX30102 Activated!”, when button one is pressed again, “MAX30102 Deactivated” is seen, which ensures accessibility to the users.

```
197
198     u8g2.clearBuffer();
199     u8g2.setFont(u8g2_font_ncenB08_tr);
200     u8g2.drawString(3, 12, "Smart Vitals");
201     u8g2.drawString(3, 28, maxSensorActive ? "MAX30102 Activated!" : "MAX30102 Deactivated!");
202
203     u8g2.sendBuffer();
```

If the IR value is less than 50000, the message below is seen similarly, if no finger is detected on the sensor, the message is displayed.

```
305
307     if (irValue < 50000) {
308         Serial.println("Please place your finger on the sensor.");
309         u8g2.clearBuffer();
310         u8g2.setFont(u8g2_font_ncenB08_tr);
311         u8g2.drawString(3, 12, "Smart Vitals ");
312         u8g2.drawString(3, 28, "Please place your");
313         u8g2.drawString(3, 44, "finger on the sensor.");
314         u8g2.sendBuffer();
315         delay(1000);
316         return;
317     }
318 }
```

### 7.1.5 Hardware Enclosure and Final Assembly

After the system was ready, it was necessary to make the system compact and the connection to be intact. So, all the hardware components were placed inside a custom printed 3D enclosure using Creality Ender 3, a 3D printing machine. Additionally, a separate container was also printed for power bank module and li – ion batteries.



*Figure 29: Hardware Enclosure of Smart Vitals*

### 7.1.6 Dependencies in Flutter

The “pubspec.yaml” file below consist of all the dependencies like -maps, tts, geolocator, mailer, flutter\_dotenv, etc. including all the settings which are required to run and build the Flutter based mobile application for the project, SmartVitals.

```
30  dependencies:
31    flutter:
32      |  sdk: flutter
33
34    # The following adds the Cupertino Icons font to your application.
35    # Use with the CupertinoIcons class for iOS style icons.
36    cupertino_icons: ^1.0.8
37    http: ^1.3.0
38    fl_chart: ^0.71.0
39    font_awesome_flutter: ^10.8.0
40    firebase_core: ^3.13.0
41    firebase_auth: ^5.5.2
42    google_sign_in: ^6.3.0
43    provider: ^6.1.4
44    cloud_firestore: ^5.6.6
45    firebase_messaging: ^15.2.5
46    firebase_storage: ^12.4.5
47    get: ^4.7.2
48    shared_preferences: ^2.5.3
49    intl: ^0.20.2
50    path_provider: ^2.1.5
51    url_launcher: ^6.3.1
52    geocoding: ^3.0.0
53    latlong2: ^0.9.1
54    geolocator: ^14.0.0
55    flutter_map: 6.0.0
56    sqflite: ^2.4.2
57    flutter_tts: ^4.2.2
58    mailer: ^6.4.1
59    flutter_dotenv: ^5.2.1
60
61  dev_dependencies:
62    |  flutter_test:
63      |    |  sdk: flutter
64
```

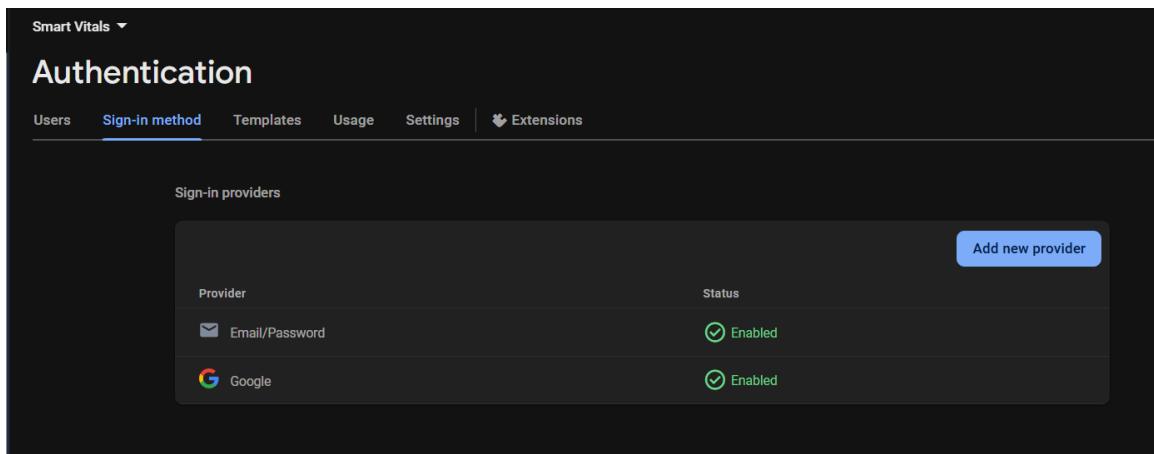
### 7.1.7 Firebase Configuration in Mobile Application

The google-service.json file code snippet is given below, the file consists of configuration details required for connecting the firebase services like, database, authentication and storage with the flutter mobile application. It includes configuration details like: project number, project id, firebase services, and Api keys.

```
1  [
2    "project_info": {
3      "project_number": "1234567890",
4      "project_id": "smash-test-12345",
5      "storage_bucket": "smash-test-12345.appspot.com"
6    },
7    "client": [
8      {
9        "client_info": {
10          "mobilesdk_app_id": "1:1234567890:android:1234567890abcdef",
11          "android_client_info": {
12            "package_name": "com.example.app1"
13          }
14        },
15        "oauth_client": [],
16        "api_key": [
17          {
18            "current_key": "AAAAA...ZZZ"
19          }
20        ],
21        "services": {
22          "appinvite_service": [
23            "other_platform_oauth_client": []
24          ]
25        }
26      ],
27      "configuration_version": "1"
28    ]
29 ]
```

### 7.1.8 Sign – in method in Firebase Authentication

The screen shot below shows the method through which the users can sign in to the smart vitals app. There are two sign – in providers Email/Password and via Google account.



The screenshot shows the Firebase Authentication interface under the 'Sign-in method' tab. It lists two providers: 'Email/Password' and 'Google', both of which are enabled. An 'Add new provider' button is visible at the top right of the provider list.

Provider	Status
Email/Password	Enabled
Google	Enabled

## 7.2 Key Code Components and Logic

### 7.2.1 Firebase rules for read and write

The screenshot shows the read and write access given to authorized users, the user can only access those files that are self-uploaded. The conditions are checked before allowing any user to access the data or update their data.

The screenshot shows the Firebase Rules Playground interface. On the left, a sidebar lists recent changes made to the rules, each with a timestamp and a small circular icon. On the right, the main area displays the Firestore security rules code.

```
1  rules_version = "2";
2  service cloud.firestore {
3      match /databases/{database}/documents {
4          match /users/{userId} {
5              // Allow users to read and write only their own data
6              allow read, write: if request.auth != null && request.auth.uid == userId;
7
8              // Allow users to access their own blood pressure subcollection
9              match /bloodPressure/{documentId} {
10                  allow read, write: if request.auth != null && request.auth.uid == userId;
11
12                  // Temperature subcollection rules
13                  match /temperature/{documentId} {
14                      allow read, write: if request.auth != null && request.auth.uid == userId;
15
16                  }
17
18                  // Pulse Subcollection
19                  match /pulse_history/{documentId} {
20                      allow read, write: if request.auth != null && request.auth.uid == userId;
21
22
23                  //SPO2 Subcollection rules
24                  match /spo2_history/{documentId} {
25                      allow read, write: if request.auth != null && request.auth.uid == userId;
26
27                  }
28
29  }
```

### 7.2.2 Account Creation via Firebase

The code below shows, the creation of new user account with email and password in the Firebase Authentication. Then updated the account created with the user's name, and then retrieving the unique UID which is used to link with the firestore. The user data is stored in users' collection in Firebase with document for user information.

```

423
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455
    // Create user with Firebase Authentication
    FirebaseAuth.instance
        .createUserWithEmailAndPassword(
            email: emailController.text.trim(),
            password: passwordController.text,
        )
        .then((userCredential) async {
            // After creating the user, update the user's profile with the name
            await userCredential.user?.updateProfile(
                displayName: name.text,
            );
            // Get the user ID from Auth
            String uid = userCredential.user!.uid;
            // Create a document in Firestore's users collection
            await FirebaseFirestore.instance
                .collection('users')
                .doc(uid)
                .set({
                    'name': name.text,
                    'phone': phoneController.text.trim(), // Added phone number
                    'email': emailController.text.trim(),
                    'uid': uid,
                    'createdAt':
                        FieldValue.serverTimestamp(),
                    'lastLogin':
                        FieldValue.serverTimestamp(),
                    // Add any additional user data you want to store
                });
}

```

### 7.2.3 User Authentication for Login

When user tries to login with their email and password, the FirebaseAuth.instance check for the same user credentials in Firebase Authentication, if found the user is redirected to the homepage.

```

try {
    if (isLogin) {
        await FirebaseAuth.instance.signInWithEmailAndPassword(
            email: emailController.text.trim(),
            password: passwordController.text,
        );
        Dialogs.showSnackbar(context, 'Welcome back!');
    }
}

if (FirebaseAuth.instance.currentUser != null) {
    Navigator.pushReplacement(
        context,
        MaterialPageRoute(builder: (_) => HomePage()),
    );
}

```

#### 7.2.4 GPS Location for tracking device

The code snippet below fetches the current location of the device by using “getCurrentPosition( )” function. The fetched location is then parsed into user readable location, updating the UI and the text box as well, Additionally, the distance is also calculated and the location is finally saved in the location history.

```
426 Future<void> _getCurrentPosition() async {
427   if (!await _handleLocationPermission()) return;
428
429   try {
430     setState(() => _isLoading = true);
431
432     Position position = await Geolocator.getCurrentPosition();
433
434     setState(() {
435       _currentLatitude = position.latitude;
436       _currentLongitude = position.longitude;
437     });
438
439     List<Placemark> placemarks =
440       await placemarkFromCoordinates(position.latitude, position.longitude);
441
442     if (placemarks.isNotEmpty) {
443       Placemark place = placemarks[0];
444       final address = "${place.subLocality ?? ''}, ${place.locality ?? ''}, ${place.country ?? ''}".replaceAll(RegExp(r'\^', ''));
445
446     setState(() {
447       _currentAddress = address;
448       _startLocationController.text = _currentAddress!;
449       _startLatitude = position.latitude;
450       _startLongitude = position.longitude;
451
452       if (_destinationLatitude != null) {
453         _calculateDistance();
454         _updateMap();
455       }
456     });
457
458     // Save this location to history
459     await _saveLocationToHistory(position.latitude, position.longitude, address);
460   }
461 }
```

#### 7.2.5 Voice Alert and Email Notification

The code below firstly checks the temperature readings, if reading is not within the defined threshold, voice alert is triggered which reads the \_speakAlert text, which is possible via text-to-speech functionality.

```

    if (temp >= 99 || (temp<=95 && temp>0)) {
      await _speakAlert('Warning! Critical temperature detected!');
      await sendEmailFromGmail(temp);
      return 'Critical';
    }
    return 'Normal';
  }

  final FlutterTts _tts = FlutterTts();

  Future<void> _speakAlert(String message) async {
    await _tts.setLanguage('en-US');
    await _tts.setSpeechRate(0.5);
    await _tts.setVolume(1.0);
    await _tts.speak(message);
  }

```

Additionally, an Email alert is also sent, via email that has been setup in the environment variable. Along with the alert message, location has also been sent which allows users to get knowledge of the device location. When clicked on the URL of the map it should redirect user to the location.

```

final gmailSmtp = gmail(dotenv.env['GMAIL_EMAIL']!,dotenv.env["GMAIL_PASSWORD"]!);

//email send
sendEmailFromGmail(temp) async {
  // print(location);
  final mapUrl = "https://www.google.com/maps?q=$location";

  final message = Message()
    ..from=Address(dotenv.env["GMAIL_EMAIL"]!,'Temperature Alert')
    ..recipients.add(_currentUser?.email)
    ..subject='Alert for temperature'
    ..text="Warning! Critical temperature detected! Temperature is $temp .The current location of the user is $mapUrl";

  try{
    await send(message,gmailSmtp);
  } on MailerException catch (e){
    print('message not Sent');
  }
}

```

### 7.2.6 Storing and Retrieving data form Firestore

The vital history is saved after checking the condition, whether temperature is null or not, if it's not null then the reading is saved locally using 'SharedPreferences', then a well structure is created to store the reading to the Firestore under the users' profile.

```

if (newTemp != null && newTemp != 0) {
    // Save current reading to SharedPreferences for quick access
    final prefs = await SharedPreferences.getInstance();
    await prefs.setDouble('lastTemp', newTemp);

    // Create new temperature data
    final newReading = {
        'temperature': newTemp,
        'timestamp': FieldValue.serverTimestamp(),
        'serverTimestamp': serverTimestamp,
        'status': await _getTemperatureStatus(newTemp),
    };

    // Save to Firestore
    await _firestore
        .collection('users')
        .doc(_currentUser!.uid)
        .collection('temperature')
        .add(newReading);

    // Reload data to update UI
    await _fetchTemperatureHistory();
}

```

### 7.2.7 Firebase Configuration for specific platform in Flutter

The code below shows how android platform is configured in the Firebase which allows the app to initialize Firebase based on the usage of current platform.

```

50
51     static const FirebaseOptions android = FirebaseOptions(
52         apiKey: '',
53         appId: '1',
54         messagingSenderId: '',
55         projectId: 'smart',
56         storageBucket: 's',
57     );
58

```

## 7.3 End - to - End Process Flow of the Smart Vitals

### 7.3.1 Device Process Flow

The smart vitals system is developed in such a way that it is easy to operate by the end users. The system works in a very simple way, the step-by-step guidelines on how user can access the system are listed below:

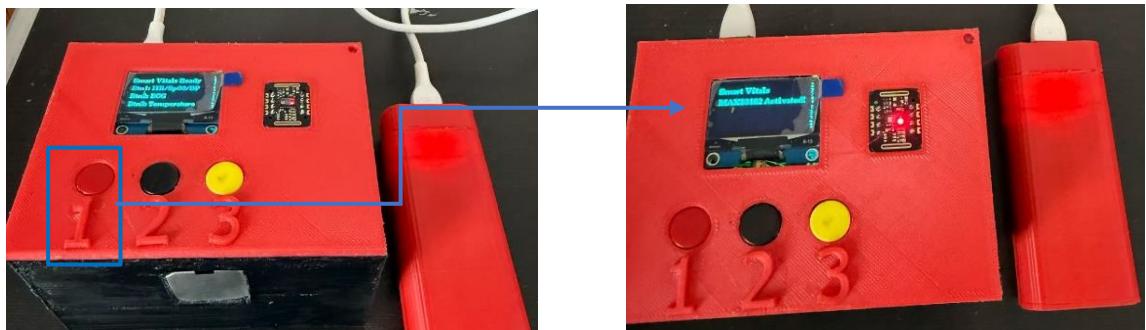
The system turns on when the user plugs the power bank module with the device, using type b cable.



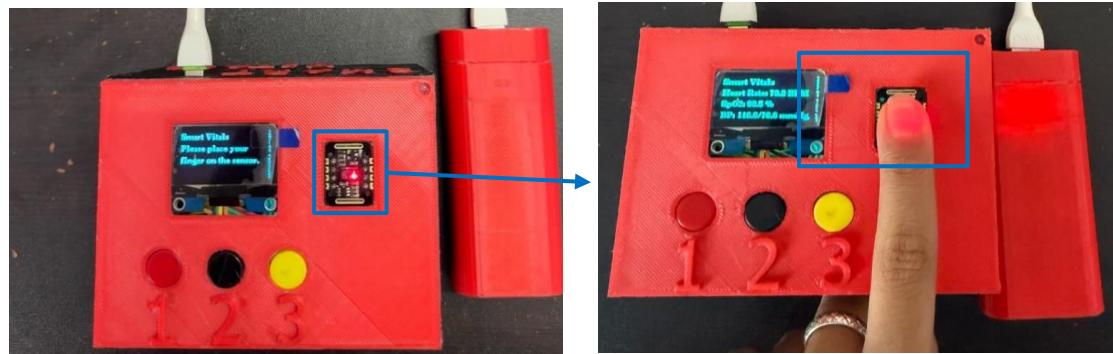
After the system is turned on, the user can view instructions on which button to press such as button1 for heart rate, SpO<sub>2</sub> and Blood pressure, button 2 for ECG waveforms and button 3 for Body temperature measurement.



User can press button 1 to activate MAX30102 sensor which gives the readings for Heart rate, SpO<sub>2</sub>, and blood pressure.



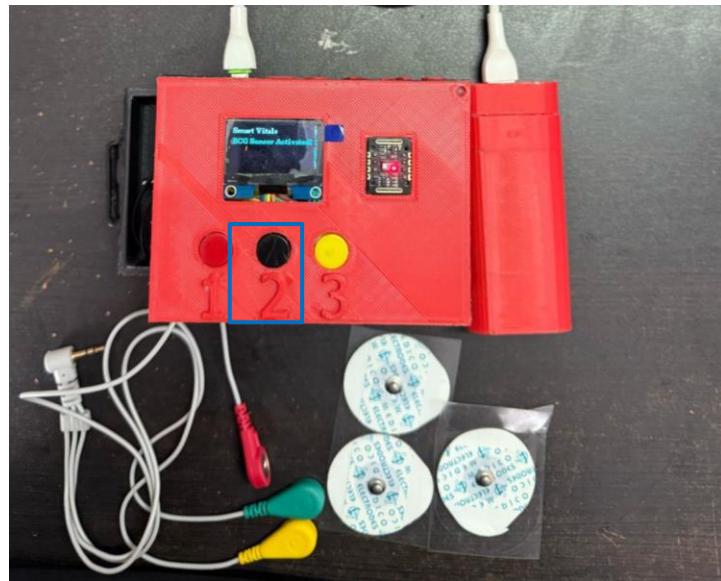
The user should place their finger on the sensor properly to take measurement which is displayed on the OLED screen placed at top of the device. When user removes their finger, the sensor stops taking the reading and displays message stating "Please place your finger on the sensor."



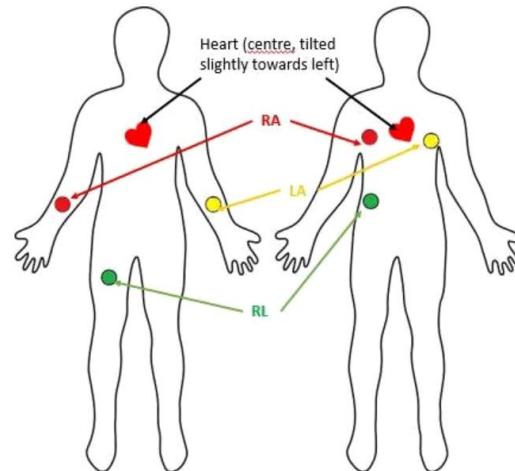
To take readings from another sensor user should press the button 1 again to deactivate the Max30102 sensor.



User can press button 2 to activate the ECG sensor. A message “ECG Sensor Activated” is seen on the OLED display. The user can then pull the drawer on the Smart Vitals box, to get access to the ECG patches.



Once the ECG sensor is activated, the user should connect the cable of the patches and place the patches properly on the right arm, left arm and right leg for accurate waveform. The patches should be placed as shown in the figure below.

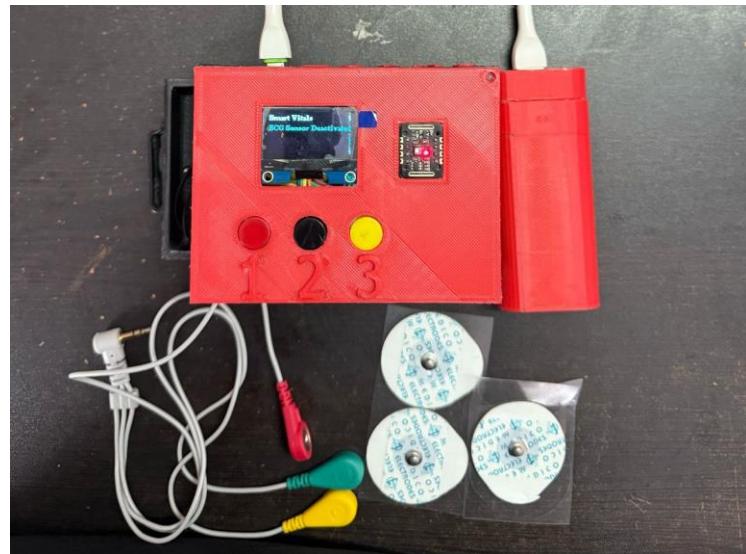


(Shah, 2021)

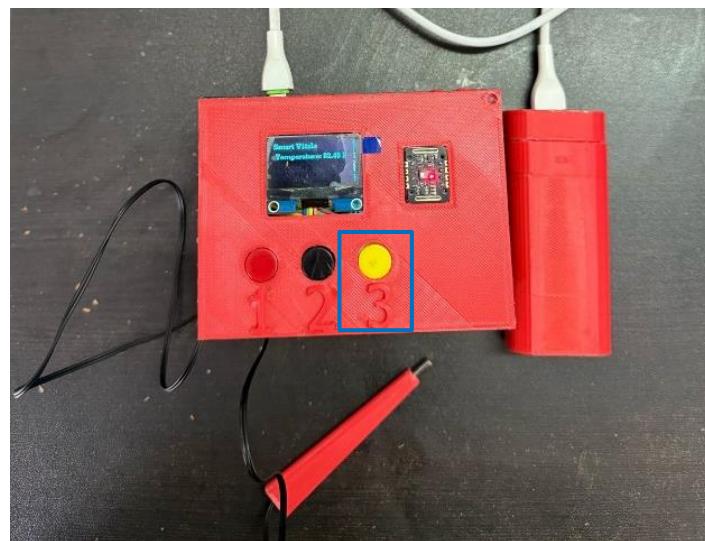
Then the waveform is displayed on the OLED screen placed at top of the device after the patches are placed correctly for proper waveform.



Similarly, to take readings from another sensor like MAX30102 and 10 K NTC thermistor thermometer, user should press the button 2 again which deactivates the ECG sensor.



User can press button 3 to activate Temperature sensor. Once the Temperature sensor is activated, the user should place the thermometer properly. It takes reading for one minute to give accurate reading. The readings from the temperature are seen on the OLED display.



User can press the reset button whenever the user faces lagging problem or to reload the OLED display, if the OLED does not respond properly.



The user can charge the power bank module which they have used prior to initialize the system by connecting it with charging port.

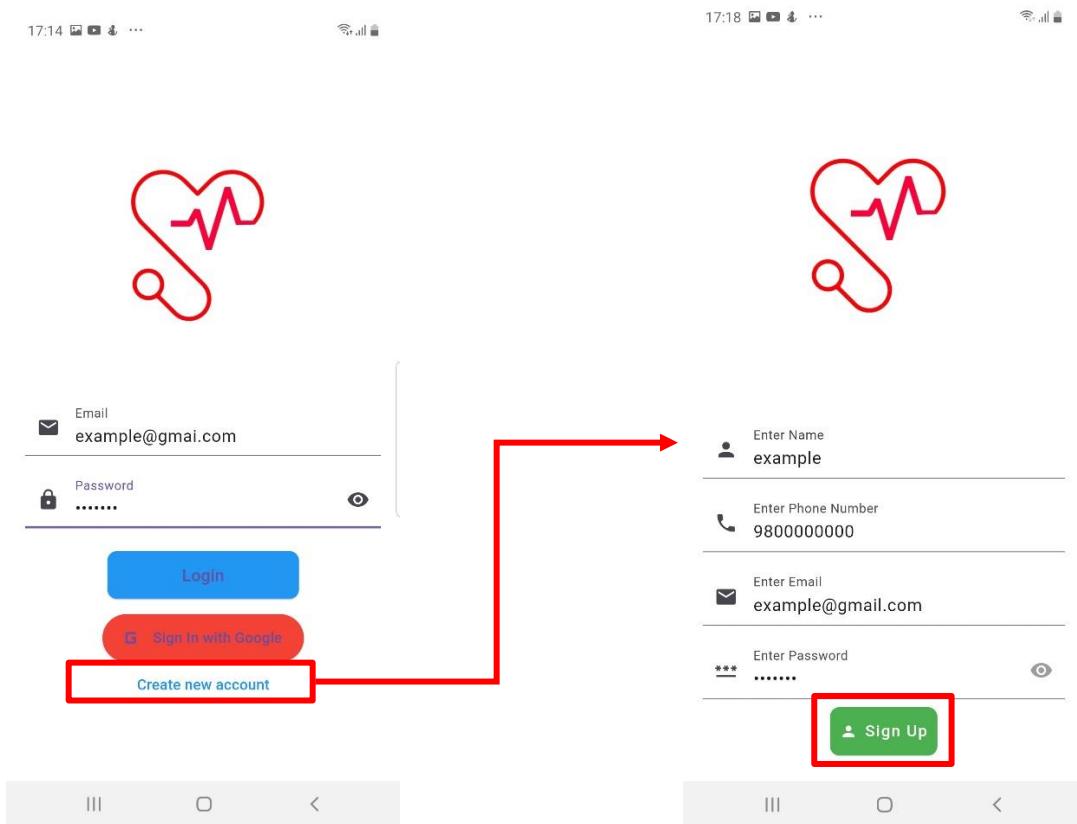


### 7.3.2 Mobile Application Process Flow

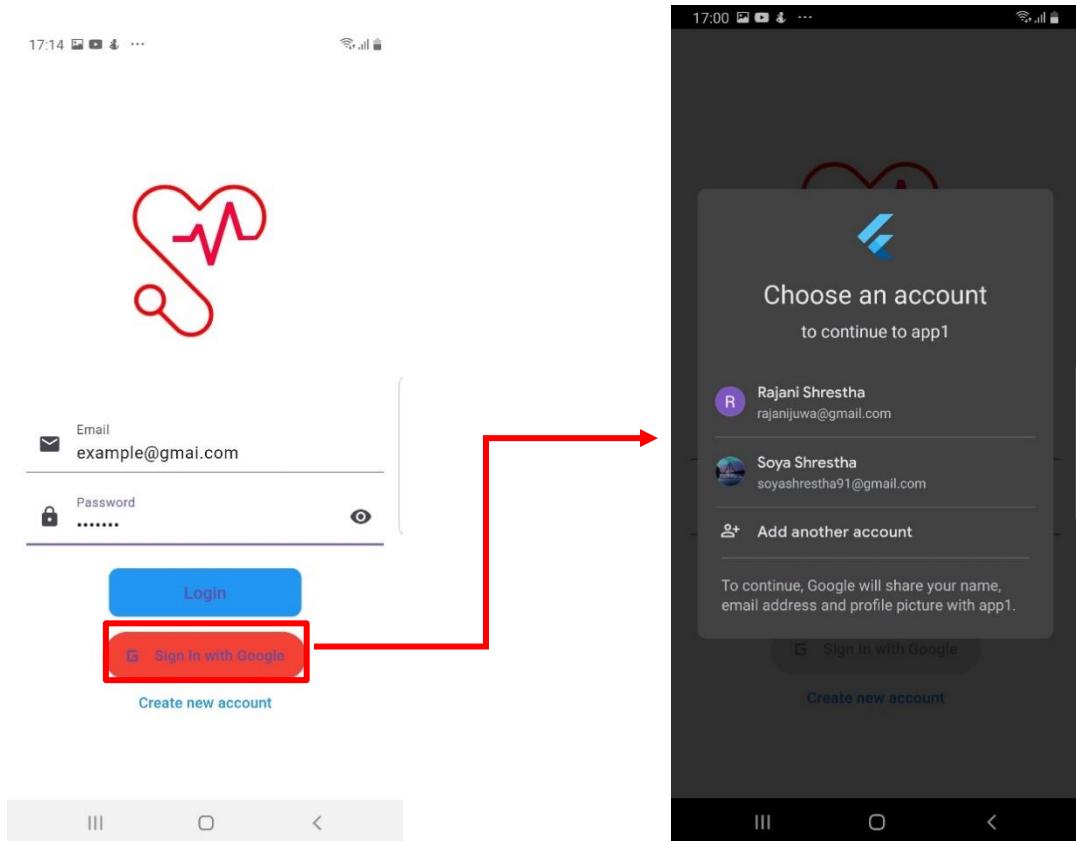
Smart Vitals system is equipped with mobile application that allows users to get benefits of many features. The step-by-step guidelines on how to get around the mobile application of smart vitals are given below:

Sign up:

User can Sign up with a valid email address, fulfilling the password criteria, their emergency contact number and user name.



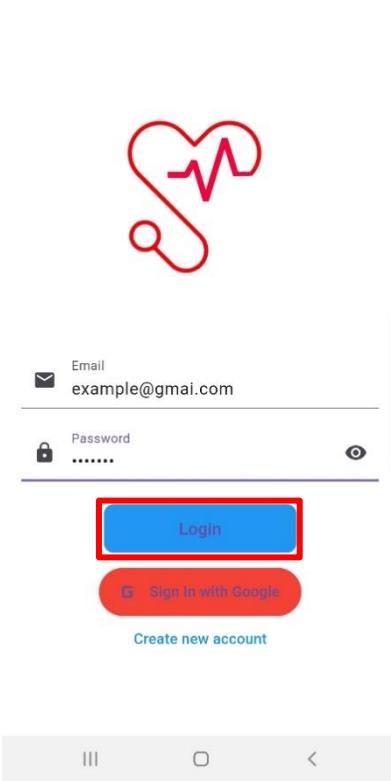
User can also sign up via Google account if they want. Once signed in from the Google account, the user is redirected to homepage.



Login:

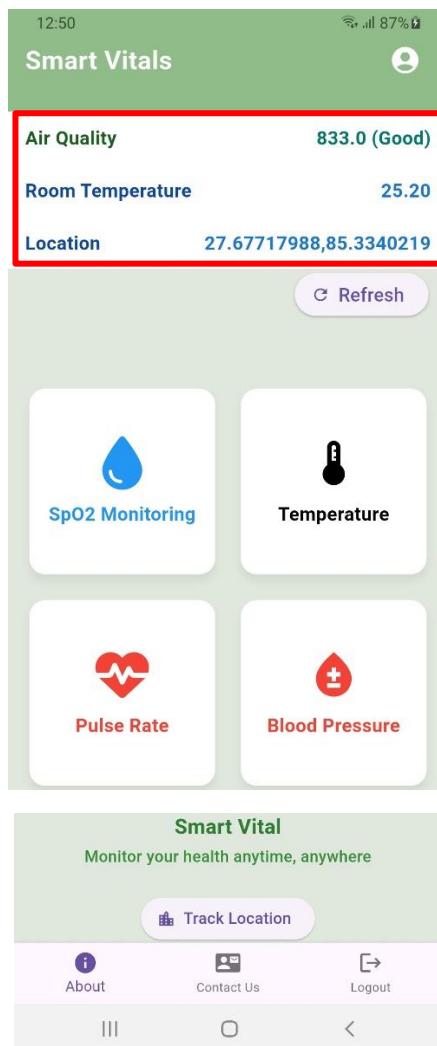
Once users' account is set up, they can login entering their previous used valid email and password and then clicking on the Login button which should redirect the user to the homepage, if there is no error.

17:14 ...

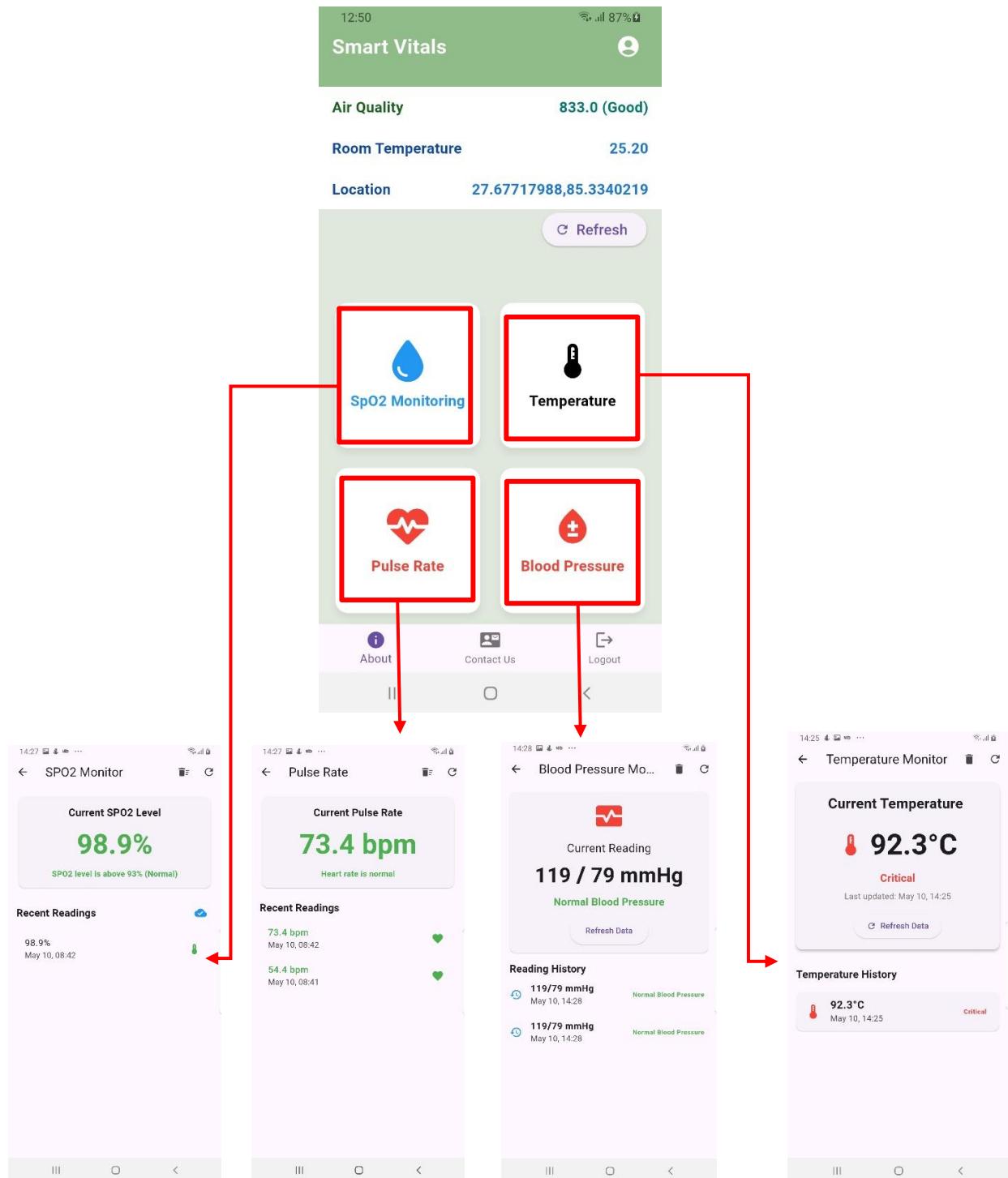


## Dashboard:

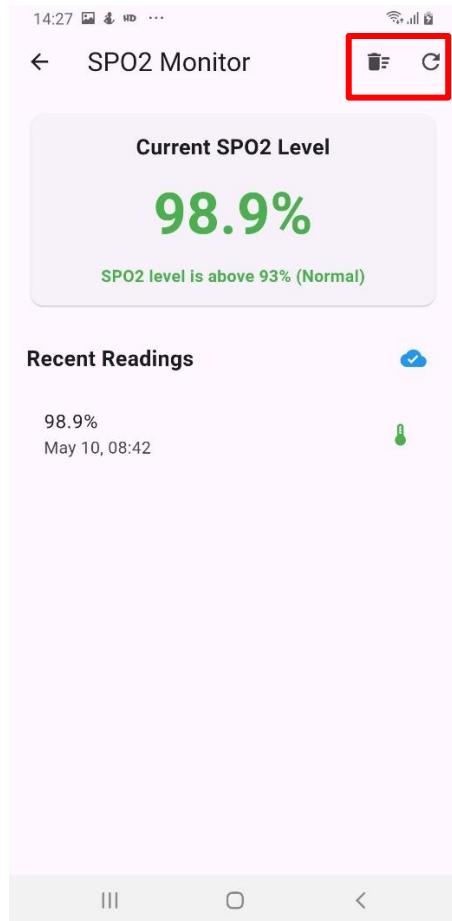
Once the user has logged in with a valid email, they are redirected to the home page. On the top of the home page, users will be able to get insights on the air quality, the current room temperature and location coordinates (latitude and longitude) of the device. User can also click on the refresh button to get the latest data on the air quality, room temperature and device location if the information is not updated.



On the main section of the dashboard users can also view, Temperature, SpO2, Heart rate and Blood Pressure cards. Clicking on any one of them redirects them to that vitals' specific page, where users can view their readings. History of vitals with date and time can be seen along with the feedback such as "Critical temperature", "Normal Blood Pressure", etc.

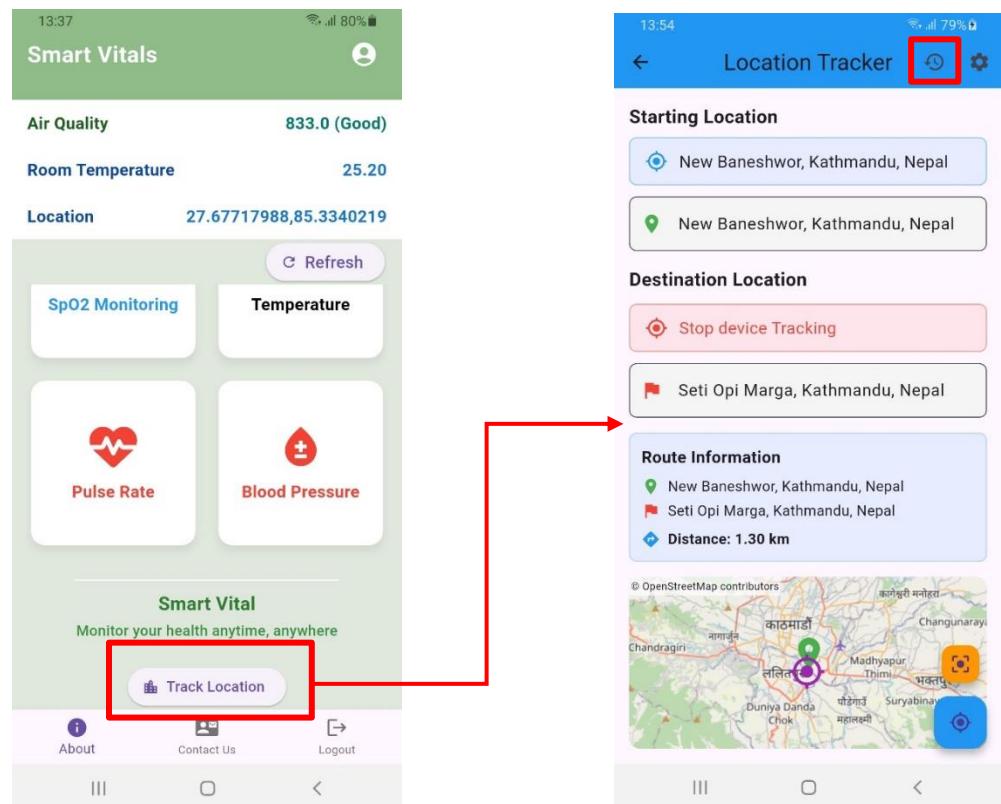


Additionally, users can also save and delete the history when they click on reload icon and trash icon respectively.



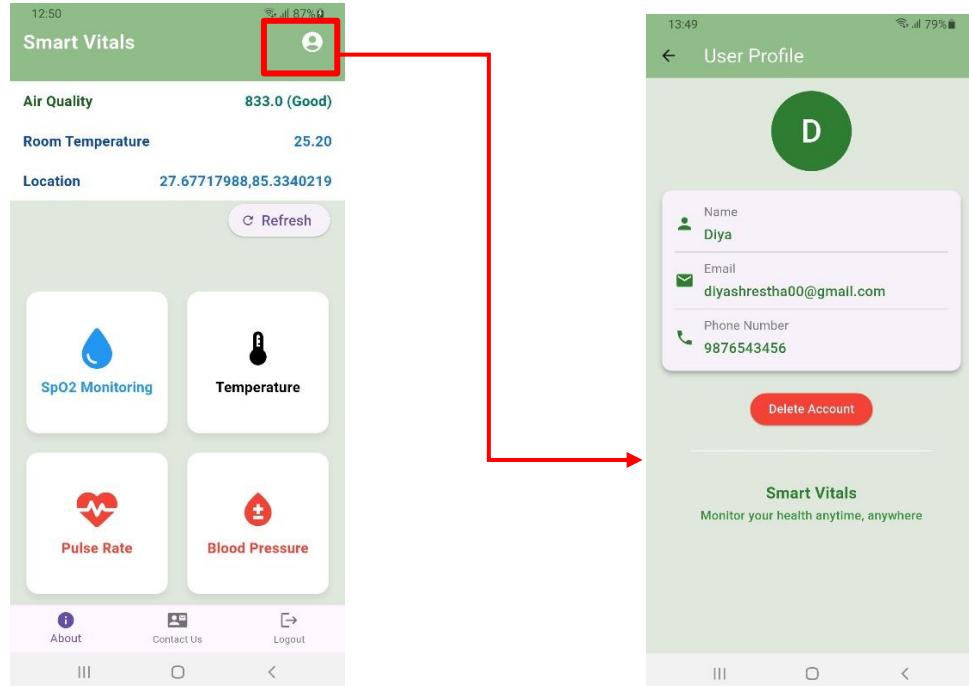
Location of the device:

When the user scrolls down, they can view track location button which redirects users to a new page where they can track the current location of the device, which comes in handy in case of emergency. Additionally, user can view location history.

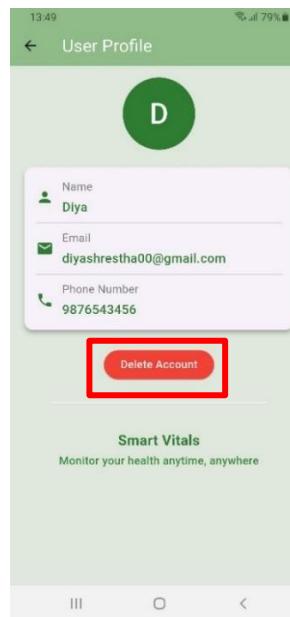


### User Profile:

The user can view their information such as user name, user email, and user phone number when the user clicks on the profile icon which is visible on the top right corner of the dashboard.

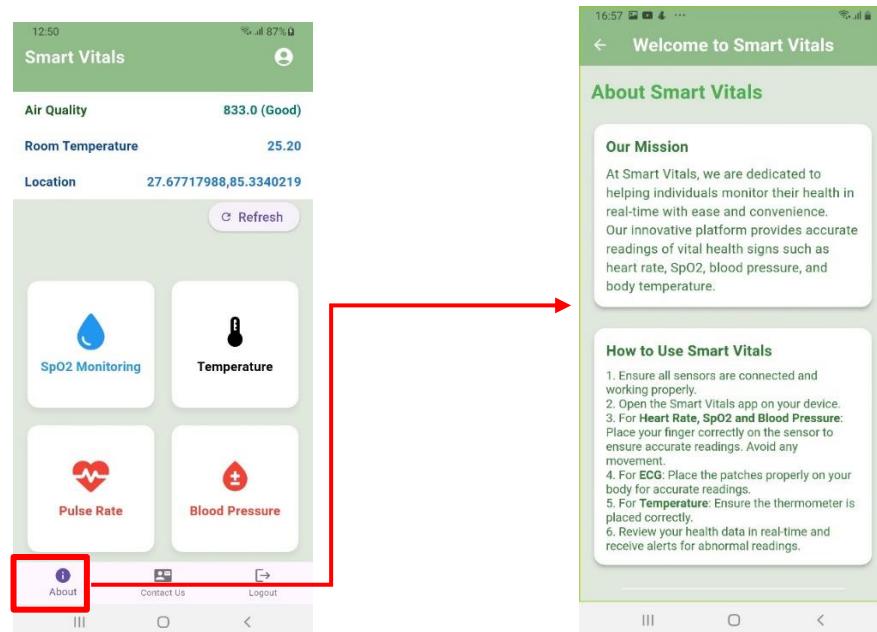


User can click on the delete button to delete their account from the User Profile, which deletes their account with their vitals history



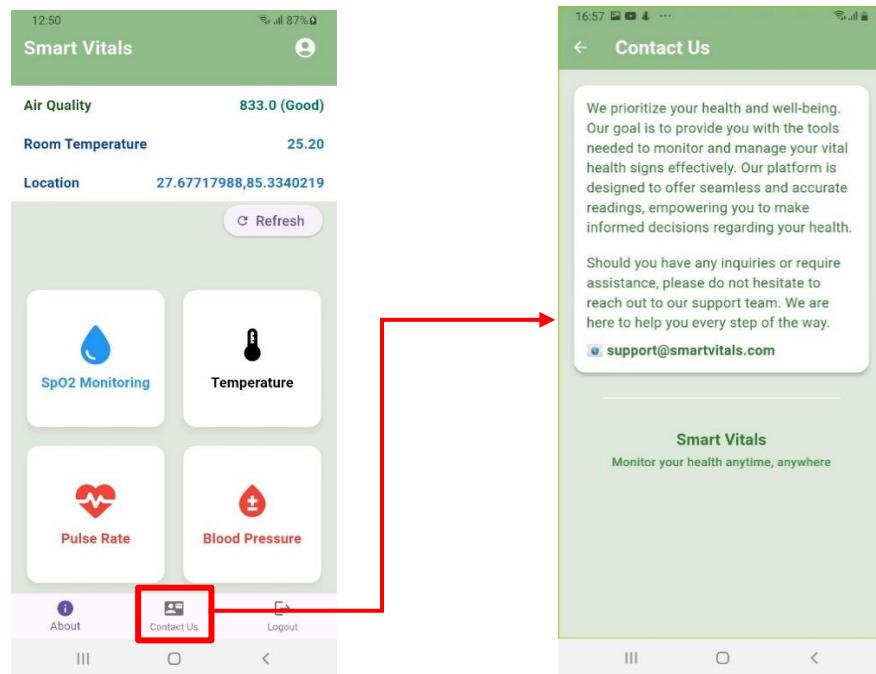
## About Us:

On the bottom navigation bar, the user can see three icons, the first one is about us icon containing information about smart vitals.



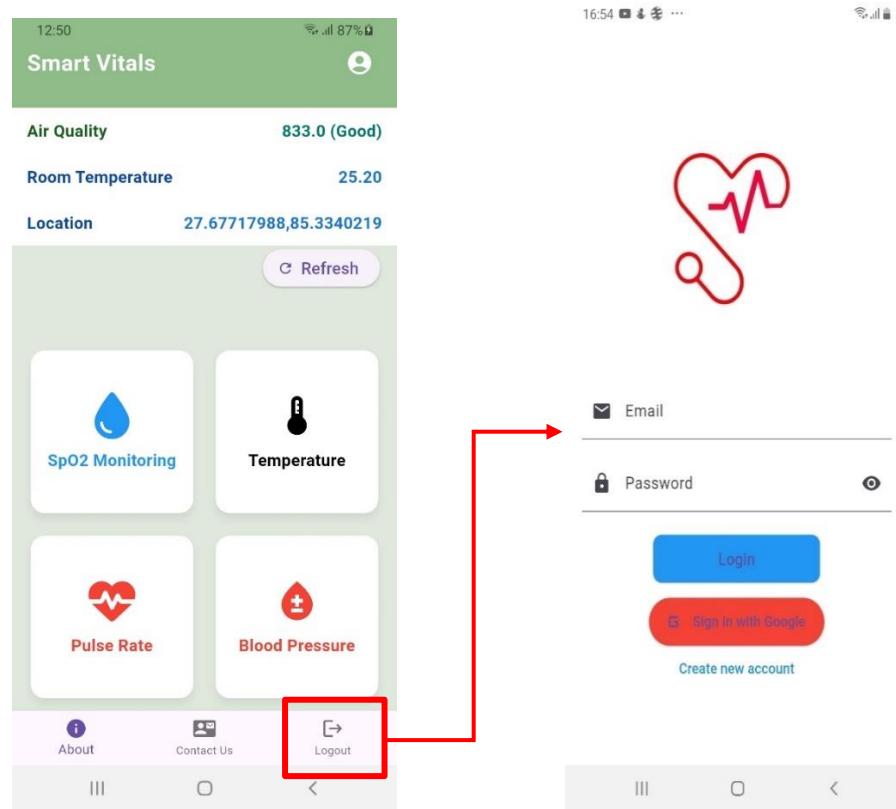
## Contact Us:

The second icon is contact us, which contains contact information of smartvitals.



Log out:

The third icon is logout icon which redirect the users to the login page.



## CHAPTER 8: PRODUCT EVALUATION

In this chapter, features of the system have been listed for device and for mobile application separately with their expected results, the outcome of those features and evaluation to know whether the feature is performing as stated or not.

### 8.1 For the Device

No.	Features	Expected	Outcome	Evaluation
1	Connect the cable	The micro controller should turn on and OLED start the display.	The micro controller and OLED is turned on.	<b>Pass</b>
2	Press the button for heart rate, SpO2 and Blood Pressure	OLED should show MAX30102 is activated.	OLED displayed “MAX 30102 Sensor Activated”.	<b>Pass</b>
3	Place the finger on the sensor	The device should start taking the reading and display it on the OLED screen.	OLED started displaying the readings.	<b>Pass</b>
4	Remove the finger from the sensor	Should ask the user to place the finger on the sensor.	“Please place your finger on the sensor” message is displayed.	<b>Pass</b>
5	Press the button for heart rate, SpO2 and Blood Pressure again	OLED should show MAX30102 is deactivated.	OLED displayed “MAX 30102	<b>Pass</b>

			Sensor Deactivated".	
6	Press the button for Temperature	The device should start taking measurement for body temperature, the reading should be visible via OLED.	The device stated taking the temperature measurements and displayed on the OLED.	<b>Pass</b>
7	Press the button for ECG	The device should activate ECG sensor. "ECG Activated" message should be displayed on the OLED screen.	OLED displayed "ECG Activated".	<b>Pass</b>
8	Place the patches	The ECG waveform should be visible via OLED.	OLED displayed ECG waveforms.	<b>Pass</b>
9	Press the button for ECG again	The device should deactivate ECG sensor showing ECG Deactivated message on the OLED display.	OLED displayed "ECG Deactivated".	<b>Pass</b>
10	Connect Type B cable with the power bank module	It should charge the battery that powers the device.	Battery is charged.	<b>Pass</b>
11	Press the reset button	It should restart the system.	System restarts.	<b>Pass</b>
12	Disconnect the cable	The device should be turned off.	The device turned off.	<b>Pass</b>

Table 2: Product Evaluation for Smart Vitals Device (System)

## 8.2 For the Mobile Application

No.	Features	Expected	Outcome	Evaluation
1	User Register	User should be able to create a new account.	New account was created.	<b>Pass</b>
2	User Sign up via Google account	User should be able to create new account via Google.	New account was clicked with sign up with google account was selected.	<b>Pass</b>
2	User Login	The app should be redirected to dashboard page when logged in with correct credentials.	Logged in via valid user credentials.	<b>Pass</b>
3	Click on SpO2 reading card	Should be redirected to different page to view SpO2 reading.	SpO2 reading is seen.	<b>Pass</b>
4	Click on delete button	Should delete the previous readings of the vitals.	Deletes the older readings of the vitals.	<b>Pass</b>
5	Click on Blood Pressure card	Should be redirected to different page to view blood pressure.	Blood pressure reading is seen.	<b>Pass</b>
6	Click on Temperature card	Should be redirected to different page to view temperature reading.	Temperature measurement is seen.	<b>Pass</b>

7	Click on Pulse rate card	Should be redirected to different page to view pulse rate.	Heart rate reading is seen.	<b>Pass</b>
8	Click on User icon	The user should be redirected to user profile page.	Redirected to user profile page.	<b>Pass</b>
9	Click on Delete button	The user should be able to delete their account.	Account is deleted when clicked on delete button.	<b>Pass</b>
10	Click on about icon	The user should be redirected to about us page.	Redirected to about us page.	<b>Pass</b>
11	Click on contact us icon	The user should be redirected to contact us page.	Redirected to contact us page.	<b>Pass</b>
12	Click on logout icon	The app should navigate back to login screen.	Redirected to login page.	<b>Pass</b>
13	Click on Track Location	The user is navigated to device location tracking page.	Redirected to device tracking page.	<b>Pass</b>
14	Click on location history	All the previous device location should be seen.	Previous device location was seen.	<b>Pass</b>

Table 3: Product Evaluation for Smart Vitals Mobile Application

# CHAPTER 9: PROJECT EVALUATION

## 9.1 Task Sheet

The screenshot shows a Microsoft Project window titled "SoyaShrestha\_77356846.MSP" with the "Task Sheet" tab selected. The task sheet displays a list of 37 tasks, each with its name, duration, start date, finish date, predecessors, and resource names. The tasks are organized into phases: Initiation, Planning, Research On Project, Training and Implementation, Testing and Evaluating, and Closing. The resources listed include various hardware and software components such as Laptop, MS Word, Project, Notebook, and sensors like MAX30100 Sensor.

	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names
1		1. Start Project	109 days	Tue 12/17/24	Sun 5/11/25		
2		2. Initiation	17 days	Tue 12/17/24	Mon 1/6/25		Laptop[1 Hardware],MS Word[1 Software]
3		2.1 Research on the module	2 days	Tue 12/17/24	Wed 12/18/24		Laptop[1 Hardware],MS Word[1 Software]
4		2.2 Research on Project title	5 days	Wed 12/18/24	Tue 12/24/24		Laptop[1 Hardware],MS Word[1 Software]
5		2.3 Review of research article	3 days	Thu 12/26/24	Sat 12/28/24		Laptop[1 Hardware],MS Word[1 Software]
6		2.4 Finalize Project title	3 days	Mon 12/30/24	Wed 1/1/25	5	Laptop[1 Hardware],MS Word[1 Software]
7		2.5 Title Submission ( Project Specification and Risk Register)	4 days	Thu 1/2/25	Mon 1/6/25	6	Laptop[1 Hardware],MS Word[1 Software],Notebook[1 Hardware],Pen[1]
8		3. Planning	16 days	Mon 1/6/25	Fri 1/24/25		Laptop[1 Hardware],MS Project[1 Software]
9		3.1 Schedule planning by breakdown the project	4 days	Mon 1/6/25	Thu 1/9/25		Laptop[1 Hardware],MS Word[1 Software]
10		3.2 Choose technologies to be used	4 days	Fri 1/10/25	Tue 1/14/25	9	Laptop[1 Hardware],MS Word[1 Software]
11		3.3 Identify hardware and system requirements with their availability and budget allocation	2 days	Wed 1/15/25	Thu 1/16/25	10	Laptop[1 Hardware],MS Word[1 Software],Notebook[1 Hardware],Pen[1]
12		3.4 Research on necessary tutorials, courses, or guides for tools and technologies to be used	4 days	Fri 1/17/25	Wed 1/22/25	11	Laptop[1 Hardware],MS Word[1 Software],Notebook[1 Hardware],Pen[1]
13		3.5 Evaluate risks and their potential impacts	3 days	Wed 1/22/25	Fri 1/24/25		Laptop[1 Hardware],MS Word[1 Software]
14		4 Research On project	17 days	Fri 1/24/25	Sun 2/16/25		Laptop[1 Hardware],MS Project[1 Software]
15		4.1 Research on IoT based projects related to my project	5 days	Fri 1/24/25	Thu 1/30/25		Laptop[1 Hardware],MS Word[1 Software]
16		4.2 Research on relevant articles	3 days	Fri 1/31/25	Tue 2/4/25		Laptop[1 Hardware],MS Word[1 Software]
17		4.3 Review different books based on IoT healthcare system	4 days	Tue 2/4/25	Fri 2/7/25		Laptop[1 Hardware],MS Word[1 Software],Notebook[1 Hardware],Pen[1]
18		4.4 Understanding the working mechanism of Arduino and sensors involved	4 days	Fri 2/7/25	Wed 2/12/25		Laptop[1 Hardware],MS Word[1 Software],Notebook[1 Hardware],Pen[1]
19		4.5 Finalize of Ethical Consent form	3 days	Wed 2/12/25	Fri 2/14/25		
20		5. Training and Implementation	47 days	Sun 2/16/25	Mon 4/21/25		Laptop[1 Hardware],MS Word[1 Software],MAX30100 Sensor[1 Hardware],3D printed Box[1]
21		5.1 Courses and Tutorials on Arduino, Sensors, and Health Monitoring	10 days	Sun 2/16/25	Thu 2/27/25		Notebook[1 Hardware],MAX30100 Sensor[1 Hardware],3D printed Box[1]
22		5.2 Enroll in online classes for flutter and dart	6 days	Fri 2/28/25	Fri 3/7/25		Notebook[1 Hardware],MAX30100 Sensors
23		5.3 Set up the development environment for C/C++	1 day	Sat 3/8/25	Sat 3/8/25		Notebook[1 Hardware],MAX30100 Sensors
24		5.4 Commence writing and implementing the project's code	8 days	Sun 3/9/25	Tue 3/18/25		Notebook[1 Hardware],MAX30100 Sensors
25		5.5 Initial testing of Sensor integration with ESP32	2 days	Wed 3/19/25	Thu 3/20/25		Notebook[1 Hardware],MAX30100 Sensors
26		5.6 Integrating custom algorithms and code with the Arduino platform for seamless functionality	8 days	Fri 3/21/25	Tue 4/1/25		Notebook[1 Hardware],MAX30100 Sensors[1 Hardware],3D printed Box[1]
27		5.7 Finalize Work In Progress with presentation	3 days	Tue 4/1/25	Thu 4/3/25		Notebook[1 Hardware],MAX30100 Sensors
28		5.8 Integrating notification system	2 days	Fri 4/4/25	Mon 4/7/25		Notebook[1 Hardware],MAX30100 Sensors
29		5.9 Develop Mobile Application using flutter	8 days	Sat 3/8/25	Tue 3/18/25		Notebook[1 Hardware],MAX30100 Sensors
30		5.10 Design and Develop PCB and 3D casing with its integration	3 days	Fri 4/18/25	Tue 4/22/25		Notebook[1 Hardware],MAX30100 Sensors
31		6. Testing and Evaluating	10 days	Tue 2/28/25	Mon 5/5/25		Notebook[1 Hardware],MAX30100 Sensors
32		6.1 System Integration Testing	3 days	Tue 4/22/25	Thu 4/24/25		Notebook[1 Hardware],MAX30100 Sensors
33		6.2 Functional Testing	3 days	Fri 4/25/25	Tue 4/29/25		Notebook[1 Hardware],MAX30100 Sensors
34		6.3 Performance Testing	4 days	Wed 4/30/25	Mon 5/5/25		Notebook[1 Hardware],MAX30100 Sensors
35		7. Closing	7 days	Mon 5/5/25	Sun 5/11/25		3D printed Box[1 Hardware],Laptop[1 Hardware]
36		7.1 Final Product Submission and Presentation	1 day	Mon 5/5/25	Mon 5/5/25		3D printed Box[1 Hardware],Laptop[1 Hardware]
37		7.2 Final Report Submission	1 day	Sun 5/11/25	Sun 5/11/25		3D printed Box[1 Hardware],Laptop[1 Hardware]

*Figure 30: Task Sheet*

The above figure represents the complete flow of how the project was successfully concluded by following a planned task sheet.

## 9.2 Gnatt Chart

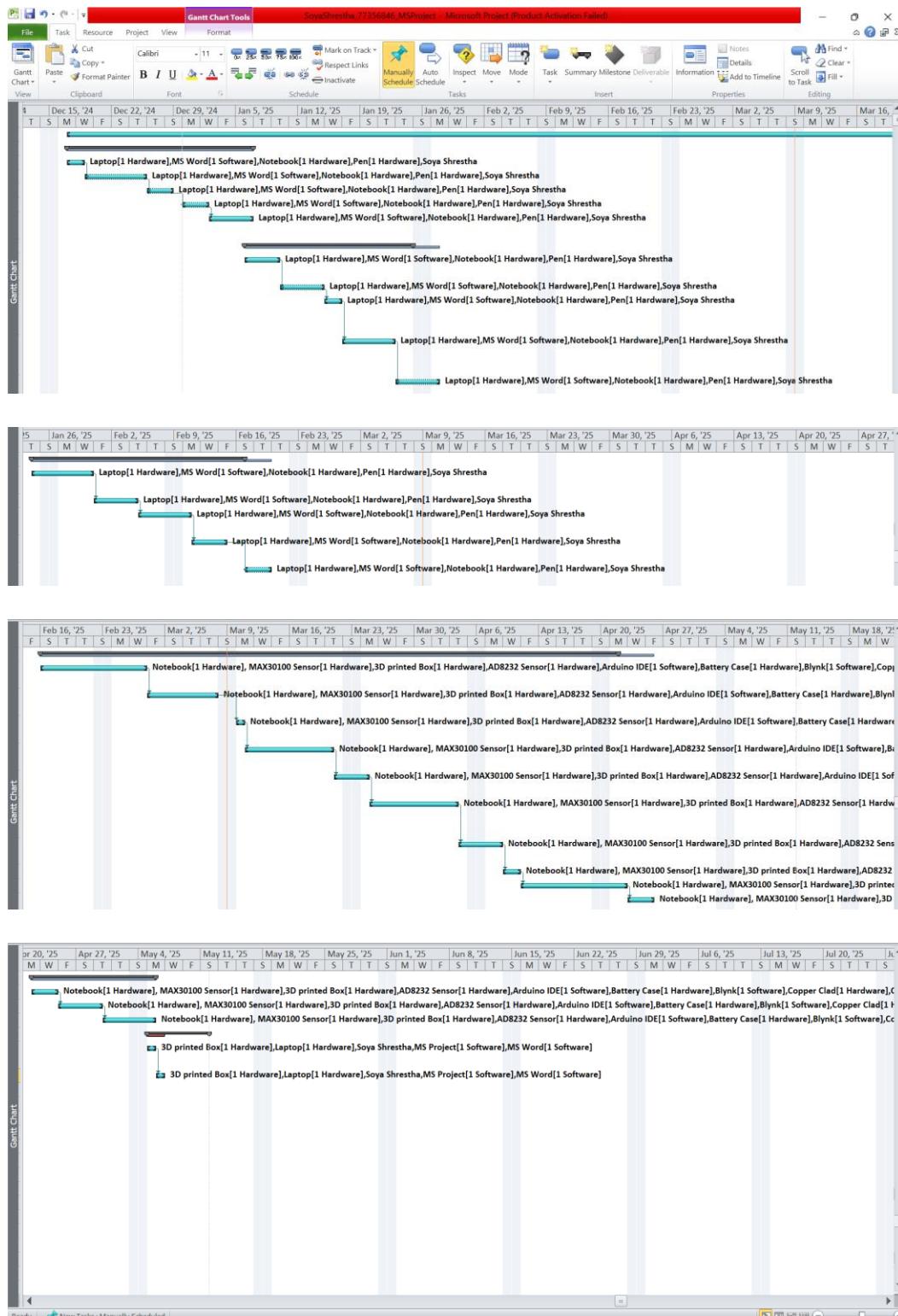


Figure 31: Gnatt Chart

The Gnatt Chart from the above figure is a visual display of the project flow, which tracks the tasks from start to the end keeping track of the project development along different dates.

### 9.3 Timeline

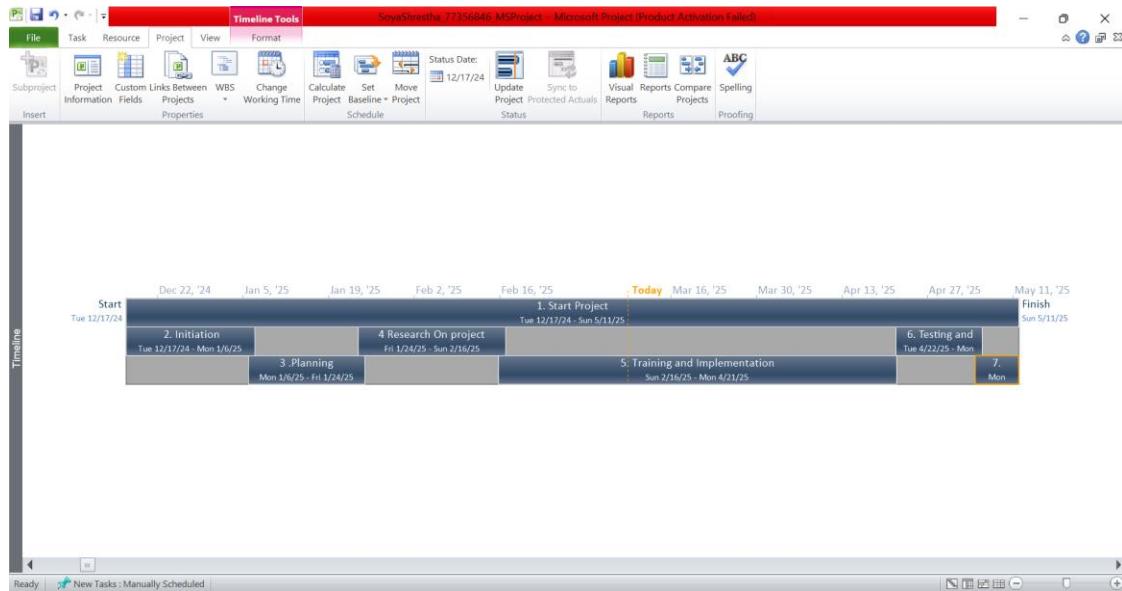


Figure 32: Project Timeline

Key stages of the project are shown in the MS Project Timeline, with initiation phase starting at 12/17/2024, followed by Planning phase, Research phase, Training and implementation phase, Testing and Evaluation phase with Closing phase marking the end of the project at 05/11/2025.

## 9.4 Resource Sheet

The screenshot shows the Microsoft Project application interface with the 'Resource Sheet' view selected. The ribbon at the top includes tabs for File, Task, Resource, Project, View, and Resource Sheet Tools. The Resource Sheet Tools tab is highlighted in orange. The status bar at the bottom indicates the project name is 'SoyaShrestha\_77356846\_MSProject' and the status is 'Microsoft Project (Product Active)'. The main area displays a resource sheet table with the following data:

Row#	Resource Name	Type	Material	Initials	Base Calendar	Code	Add New Column
1	Soya Shrestha	Work		S	Production Pro		
2	Arduino IDE	Material	Software	A			
3	Thingspeak	Material	Software	T			
4	VS Code	Material	Software	V			
5	Blynk	Material	Software	B			
6	Flutter	Material	Software	F			
7	LED	Material	Hardware	L			
8	Soldering wire	Material	Hardware	S			
9	Steel scrubber	Material	Hardware	S			
10	Soldering wax	Material	Hardware	S			
11	Soldering iron	Material	Hardware	S			
12	Silicon wire	Material	Hardware	S			
13	OLED Display	Material	Hardware	O			
14	ESP32	Material	Hardware	E			
15	USB Charger	Material	Hardware	U			
16	MAX30100 Sensor	Material	Hardware				
17	AD8232 Sensor	Material	Hardware	A			
18	Temperature Sensor	Material	Hardware	T			
19	PCB Board	Material	Hardware	P			
20	3D printed Box	Material	Hardware	3			
21	Power Adaptor	Material	Hardware	P			
22	Lithium Battery	Material	Hardware	L			
23	Switch	Material	Hardware	S			

24	Battery Case	Material	Hardware	B			
25	Ferric Chloride	Material	Hardware	F			
26	Copper Clad	Material	Hardware	C			
27	Hacksaw	Material	Hardware	H			
28	Male/ Female Header	Material	Hardware	M			
29	Screw	Material	Hardware	S			
30	screw driver	Material	Hardware	s			
31	Mobile	Material	Hardware	M			
32	Creatlity Ender -3v2 Neo	Material	Hardware	C			
33	Pen	Material	Hardware	P			
34	Notebook	Material	Hardware	N			
35	Laptop	Material	Hardware	L			
36	MS Project	Material	Software	M			
37	Ultimaker Cura	Material	Software	U			
38	MS Word	Material	Software	M			
39	TinkerCAD	Material	Software	T			
40	Wokwi	Material	Software	W			

Figure 33: Resource Sheet

The above figure consists of all the tools and technologies (Hardware and Software) used, which are essential to complete the project.

## 9.5 GitHub

The screenshot shows the GitHub interface for the 'soya-shrestha / ProductionProject' repository. The top navigation bar includes links for Code, Issues, Pull requests, Actions, Projects, Security, Insights, and Settings. A search bar at the top right allows users to search for code. Below the navigation is a 'Commits' section. A dropdown menu indicates the branch is 'main'. Filter options allow users to view commits from 'All users' over 'All time'. The commit history is listed with four entries:

- Added chapter 8 for mobile application part and made some changes in review of literature.** (soya-shrestha committed 17 hours ago) - Commit hash: e3ca159
- Updated report by adding chapter 8 product evaluation, for device.** (soya-shrestha committed 19 hours ago) - Commit hash: a3e234d
- Added dataflow diagram and updated report** (soya-shrestha committed yesterday) - Commit hash: b27d5e1
- Added dataflow diagram and updated report** (soya-shrestha committed yesterday) - Commit hash: 16b129e

At the bottom of the commit list, it says 'Commits on Apr 10, 2025'.

Figure 34: GitHub

GitHub was used to manage the codes and files in a systematic way ensuring regular commits to see the progression of the project. The git hub link which shows the progressions of the project is given below:

Git Hub Link: <https://github.com/soya-shrestha/ProductionProject>

## 9.6 Entity Relationship Diagram (ERD) and Composite ERD

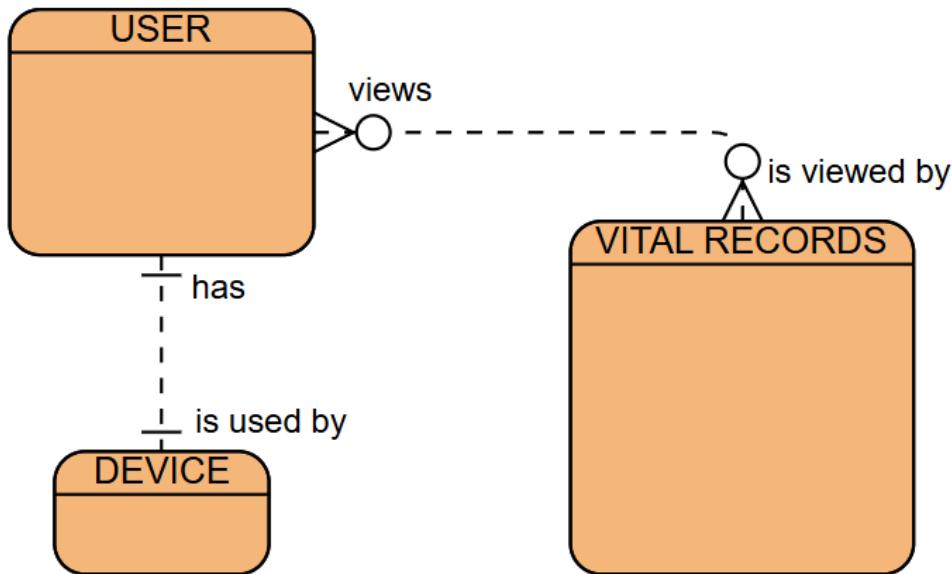


Figure 35: Entity Relationship Diagram (ERD)

The above ERD demonstrates the basic structure of how user is associated with the device and their vital records. A device is used by a user to get their vital readings. The generated vital records can be viewed by the users.

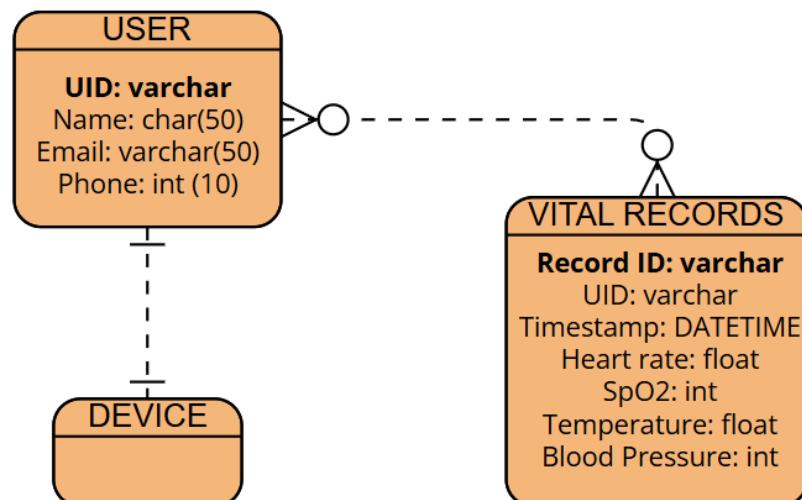


Figure 36: Composite ERD

The above figure is the Composite ERD of Smart Vitals, which shows a detailed relation between entity and their attributes; each user has their own unique UID with personal data. Vital records of each user are linked via UID (primary key) which is the foreign key to the vital records similarly Record ID is the primary key to the Vital Records entity. The entity “device” is linked with the entity “User” with one – one relationship (1:1). Similarly, “User” entity is linked with entity “Vital Records” with many – many relationship (M: N).

## 9.7 UML

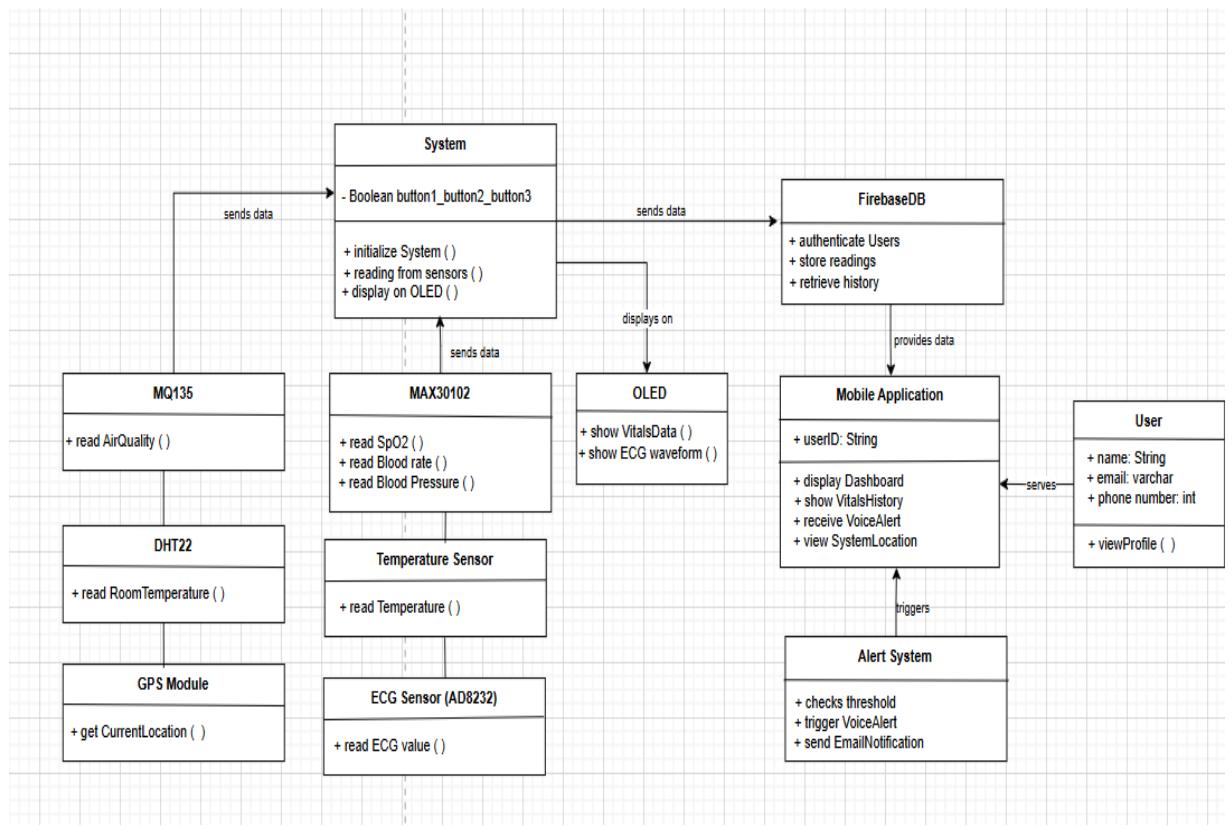


Figure 37: UML for Smart Vitals

The UML diagram below displays the structure of the Smart Vitals. The system module communicated with multiple sensors to measure health vitals in order to retrieve data via button press and environment conditions. The data retrieved via sensor are displayed on the OLED, concurrently sending data to Firebase database. The Firebase DB is then used to display data and history via mobile application linked to particular user. Additionally, alert via voice and email notification is triggered when reading is below threshold.

## 9.8 Requirement Catalogue

The tables below show the functional requirement and non – functional requirements with the MoSCoW method.

Functional Requirements	MoSCoW
For flawless interaction the device must be linked with the Wi-Fi.	M
Buttons to start and stop the measurement of vitals through various sensors.	M
OLED display to get easy and quick local access to the real-time health vitals with necessary message for user convenience.	M
Mobile application should be able to display vital readings.	S
Voice alert via mobile application for any irregularities in the readings.	S
Alert via email for unusual readings with device location.	S
The mobile application could be able to get knowledge on air quality and room temperature and device location coordinates (latitude and longitude).	C
User can save the vitals history.	C
User can delete the vitals history if they want.	C
The user could delete their profile.	C
Users could get insights on the location of the device.	C
User could be able to view location history.	C
If the OLED screens freeze the user can press the reset button to restart the micro controller.	W

Table 4: Functional Requirement for Smart Vitals

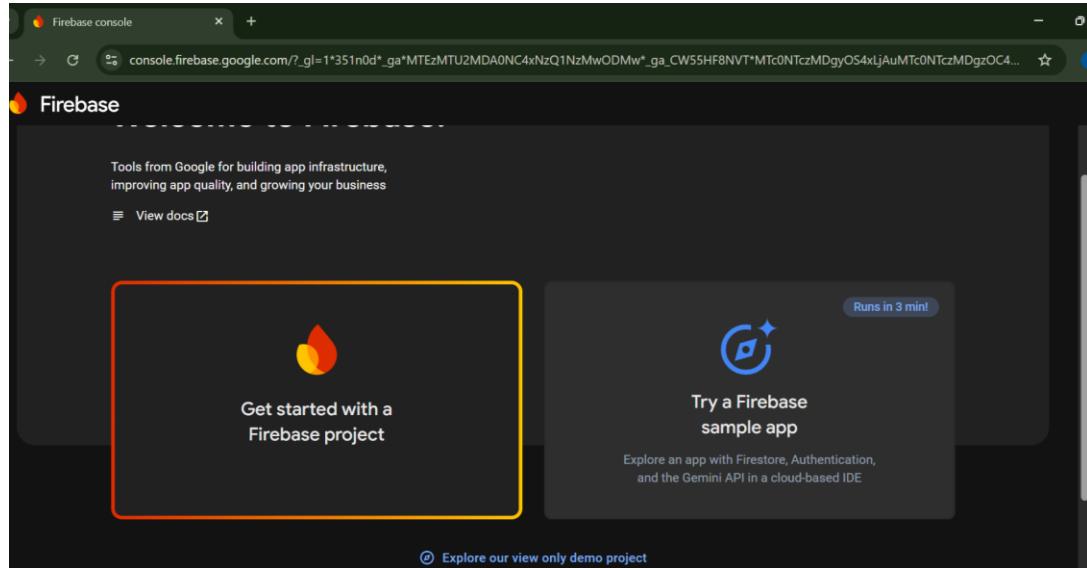
Non - Functional Requirements	MoSCoW
Smart Vitals must be convenient, compact and easy-to-use.	M
The OLED must display the measurements on the spot.	M
The battery operating the Smart Vitals should last for a day or 2.	S
Using the type B cable the Li – ion batteries should be charged.	S
Further additional of the sensor could be supported by the device.	C

Table 5: Non - functional Requirement for Smart Vitals

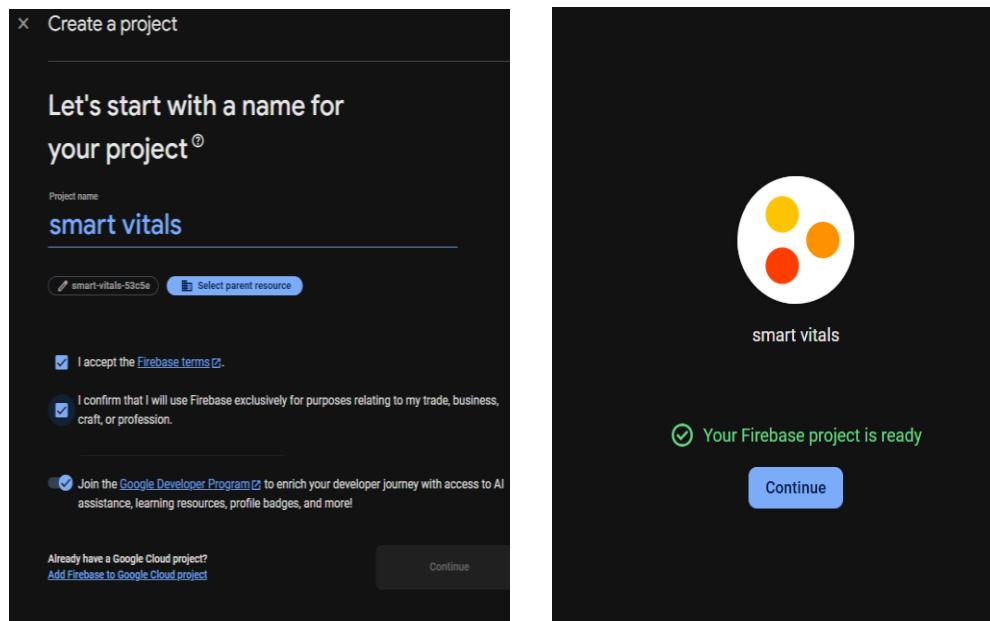
## 9.9 Installation Guidelines

### 9.9.1 Firebase Installation Guidelines

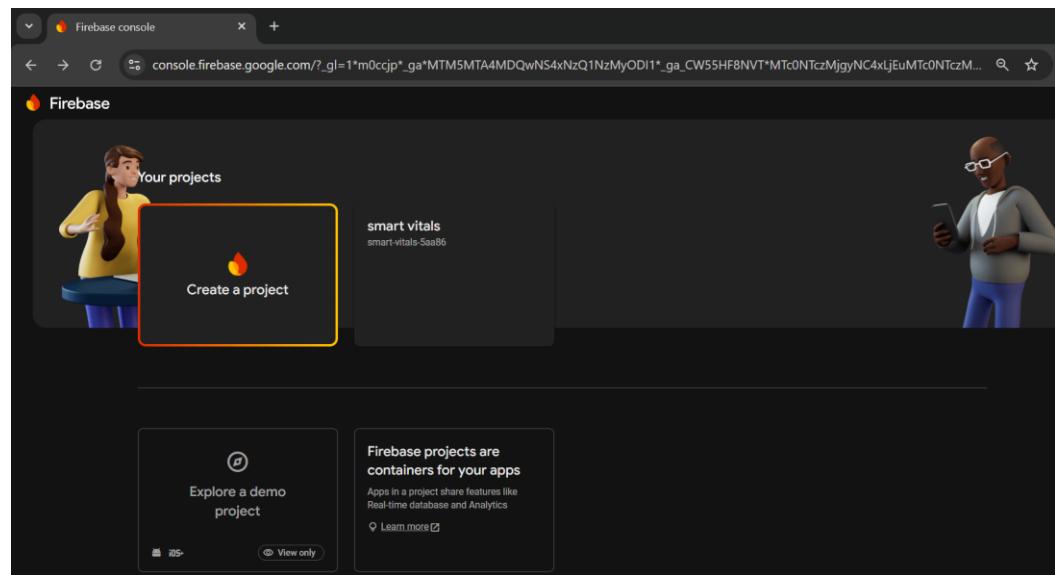
**Step 1:** Before beginning with the installation of firebase package, it is necessary to create project through firebase console by clicking on the Get started with a Firebase project.



**Step 2:** Give an appropriate name for your project, and click on continue by agreeing to the terms and conditions which will then show the Firebase project being ready.



**Step3:** All the created project can be seen in the firebase console.



**Step 4:** Once the setup for the firebase console has been done, the installation process can begin.

Open cmd on your laptop, and enter “`npm install firebase`”, this command should install necessary firebase SDK packages.

```
C:\Windows\system32\cmd. x + v  
C:\Users\uSer\Downloads\health\health>npm install firebase  
added 86 packages in 45s  
3 packages are looking for funding  
run 'npm fund' for details
```

**Step 5:** Next enter “npm install -g firebase-tools” which installs Firebase CLI, which allows us to run global different commands.

```
C:\Users\uSer\Downloads\health\health>npm install -g firebase-tools
added 630 packages in 55s

70 packages are looking for funding
  run 'npm fund' for details

C:\Users\uSer\Downloads\health\health>firebase login
i  Firebase optionally collects CLI and Emulator Suite usage and error reporting information to help improve our products. Data is collected in accordance with Google's privacy policy (https://policies.google.com/privacy) and is not used to identify you.

? Allow Firebase to collect CLI and Emulator Suite usage and error reporting information? Yes
i  To change your data collection preference at any time, run 'firebase logout' and log in again.

Visit this URL on this device to log in:
https://accounts.google.com/o/oauth2/auth?client\_id=563584335869-fgrhgmd47bqnekij5i8b5pr03ho849e6.apps.googleusercontent.com&scope=email%20openid%20https%3A%2F%2Fwww.googleapis.com%2Fauth%2Fcloudplatformprojects.readonly%20https%3A%2F%2Fwww.googleapis.com%2Fauth%2Ffirebase%20https%3A%2F%2Fwww.googleapis.com%2Fauth%2Fcloud-platform&response\_type=code&state=944150934&redirect\_uri=http%3A%2F%2Flocalhost%3A9005

Waiting for authentication...
```

**Step 6:** The command `firebase init` allows to set up the project folder with the Firebase which allows the user to build, run and deploy the app.

**Step 7:** Then, database schemas, was set up with data connection and then Dart SDK was created which enabled local building and evaluation.

```
? Are you ready to proceed? Yes
? Which Firebase features do you want to set up for this directory? Press Space to select features, then Enter to
confirm your choices. Data Connect: Set up a Firebase Data Connect service, Firestore: Configure security rules and
indexes files for Firestore, Realtime Database: Configure a security rules file for Realtime Database and (optionally)
provision default instance
== Project Setup
First, let's associate this project directory with a Firebase project.
You can create multiple project aliases by running firebase use --add,
but for now we'll just set up a default project.

? Please select an option: Use an existing project
? Select a default Firebase project for this directory: smart-vitals-dlidd (Smart Vitals )
i Using project smart-vitals-dlidd (Smart Vitals )

== Dataconnect Setup
i dataconnect: ensuring required API sqladmin.googleapis.com is enabled...
! dataconnect: missing required API sqladmin.googleapis.com. Enabling now...
+ dataconnect: required API sqladmin.googleapis.com is enabled
Wrote dataconnect\dataconnect.yaml
Wrote dataconnect\schema\schema.yaml
Wrote dataconnect\connector\connector.yaml
Wrote dataconnect\connector\queries.gql
Wrote dataconnect\connector\mutations.gql
Detected multiple app platforms in directory C:\Users\uSer\Downloads\health\health
Which platform do you want to set up a generated SDK for? Flutter (Dart)
Which connector do you want set up a generated SDK for? health/default
i Writing your new SDK configuration to C:\Users\uSer\Downloads\health\health\dataconnect\connector\connector.yaml
? File dataconnect\connector\connector.yaml already exists. Overwrite? Yes
+ Wrote dataconnect\connector\connector.yaml
i dataconnect: downloading dataconnect-emulator-2.1.0.exe...
Progress: =====> (100% of 27MB)
I0410 16:26:43.135051 18176 codgen.go:82] [connector "default" dartSdk] Generating sources into "C:\\\\Users\\\\uSer\\\\Downloads\\\\healt
h\\\\health\\\\dataconnect-generated\\\\dart\\\\default_connector"
```

**Step 8:** After that, Firebase indexes and rules which allows API of Realtime Database, creating a new Realtime instance for Database and selecting the location for database instance.

```
Firebase Security Rules allow you to define how and when to allow
requests. You can keep these rules in your project directory
and publish them with firebase deploy.

? What file should be used for Firestore Rules? firestore.rules
Firestore indexes allow you to perform complex queries while
maintaining performance that scales with the size of the result
set. You can keep index definitions in your project directory
and publish them with firebase deploy.

? What file should be used for Firestore indexes? firestore.indexes.json

== Database Setup
i database: ensuring required API firebase.database.googleapis.com is enabled...
! database: missing required API firebase.database.googleapis.com. Enabling now...
+ database: required API firebase.database.googleapis.com is enabled

? It seems like you haven't initialized Realtime Database in your project yet. Do you want to set it up? Yes
? Please choose the location for your default Realtime Database instance: us-central1
? Creating your default Realtime Database instance: smart-vitals-dlidd-default-rtdb

Firebase Realtime Database Security Rules allow you to define how your data should be
```

**Step 9:** Then the firebase setup was completed after selecting the file for security rules for Realtime Database.

```

? What file should be used for Realtime Database Security Rules? database.rules.json
+ Database Rules for smart-vitals-d1dd-default-rtdb have been written to database.rules.json.
Future modifications to database.rules.json will update Realtime Database Security Rules when you run
firebase deploy.

i Writing configuration info to firebase.json...
i Writing project information to .firebaserc...

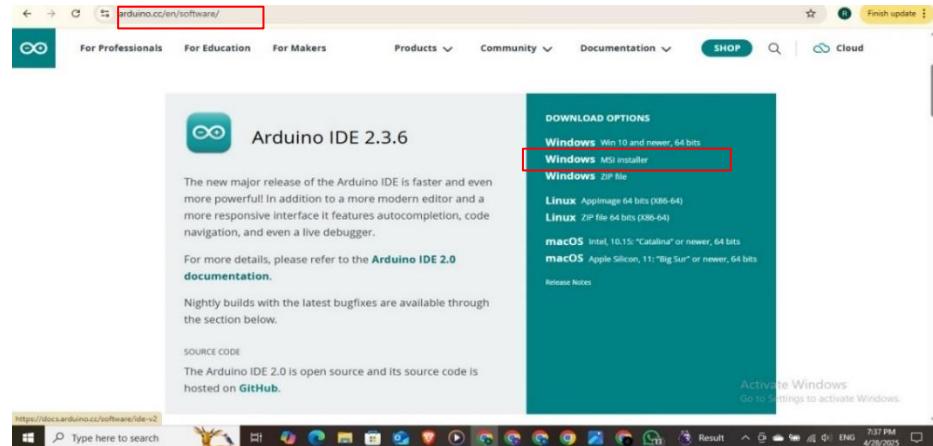
+ Firebase initialization complete!

```

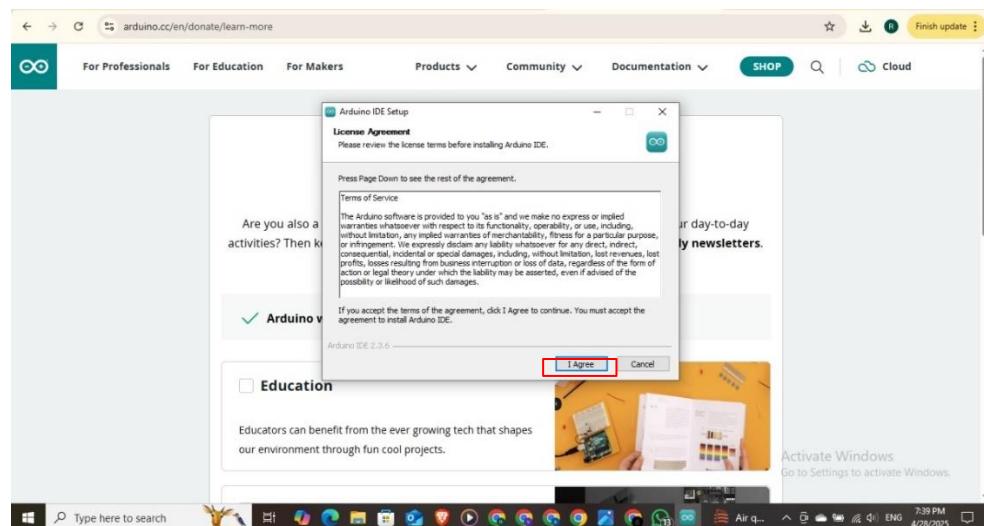
### 9.9.2 Arduino IDE installation guidelines

**Step 1:** To install Arduino IDE, we should go to:

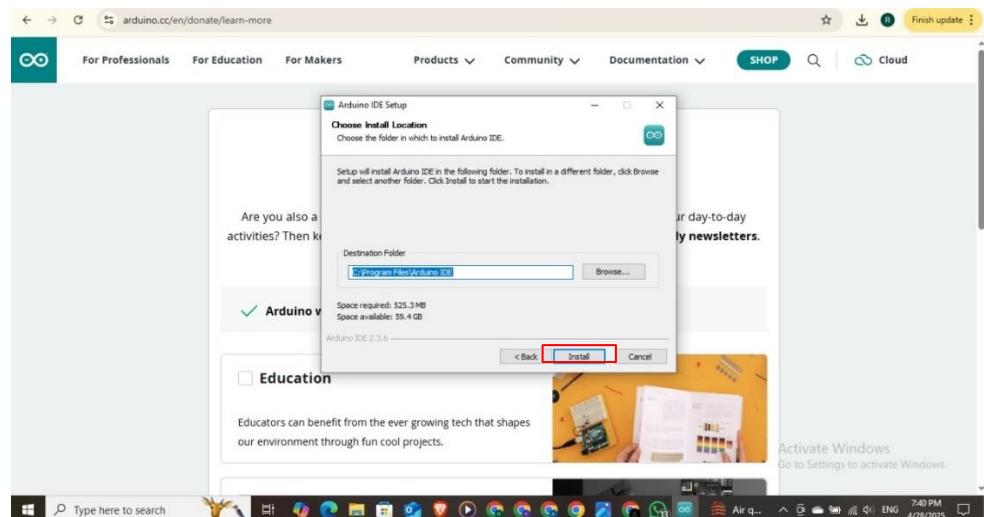
<https://www.arduino.cc/en/software/> where the Operating system should be selected.



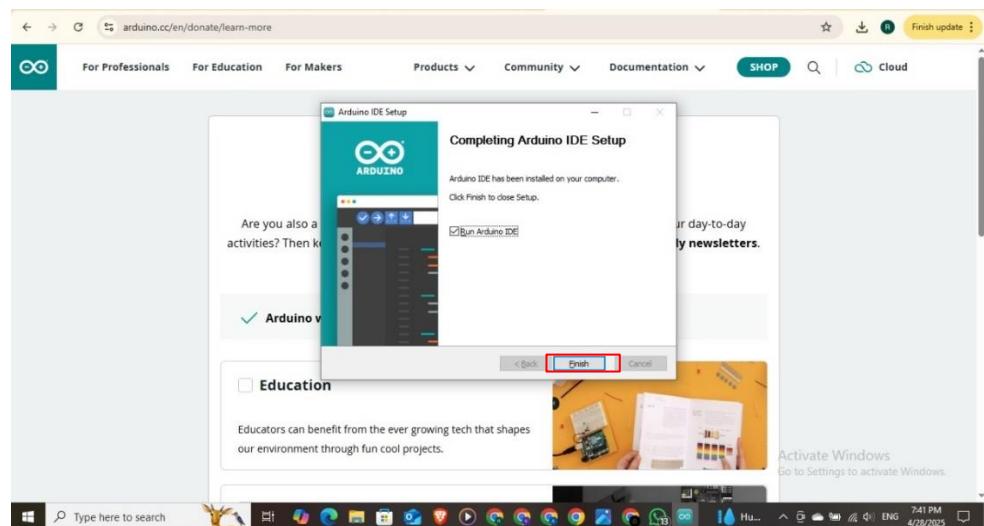
**Step 2:** Then, a License Agreement is seen where, click "I Agree", which should start the installation.



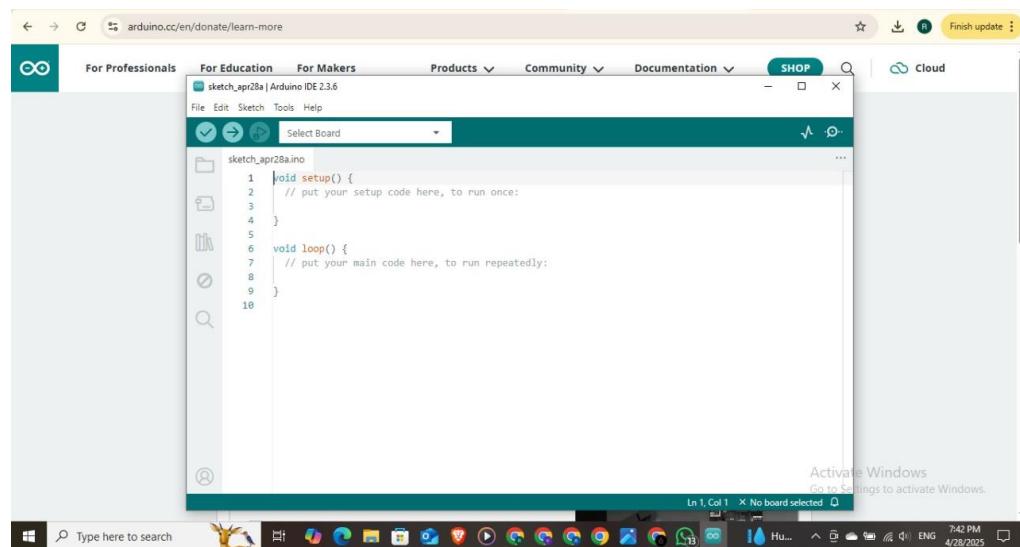
**Step 3:** After that, select the destination folder - where you want to keep your application. Then click on install which should start the installation.



**Step 4:** The setup is completed after the "Completing Arduino IDE Setup" screen is seen as below. Click on Finish to run Arduino IDE.

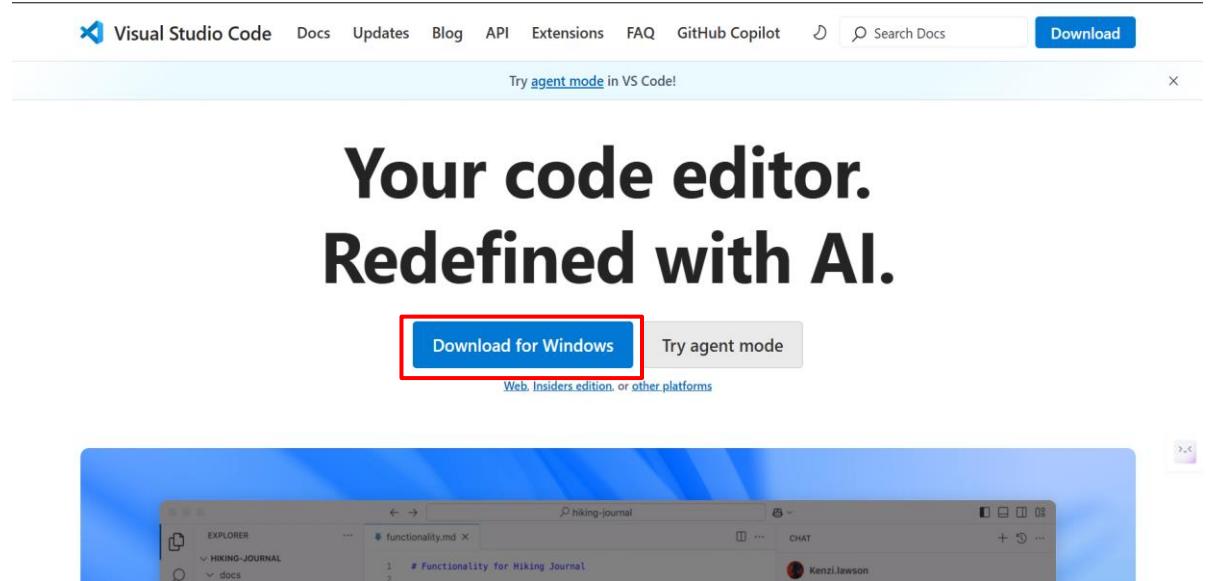


**Step 5:** As you can see, the Arduino IDE is setup and now you start coding.

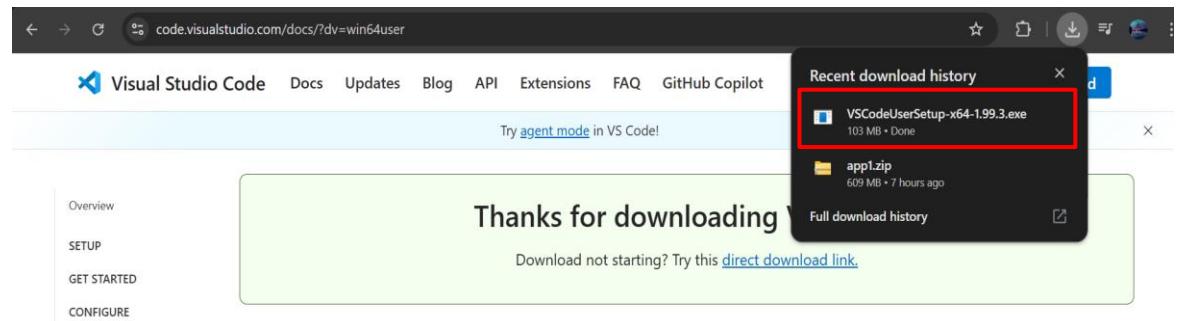


### 9.9.3 VS code installation guidelines

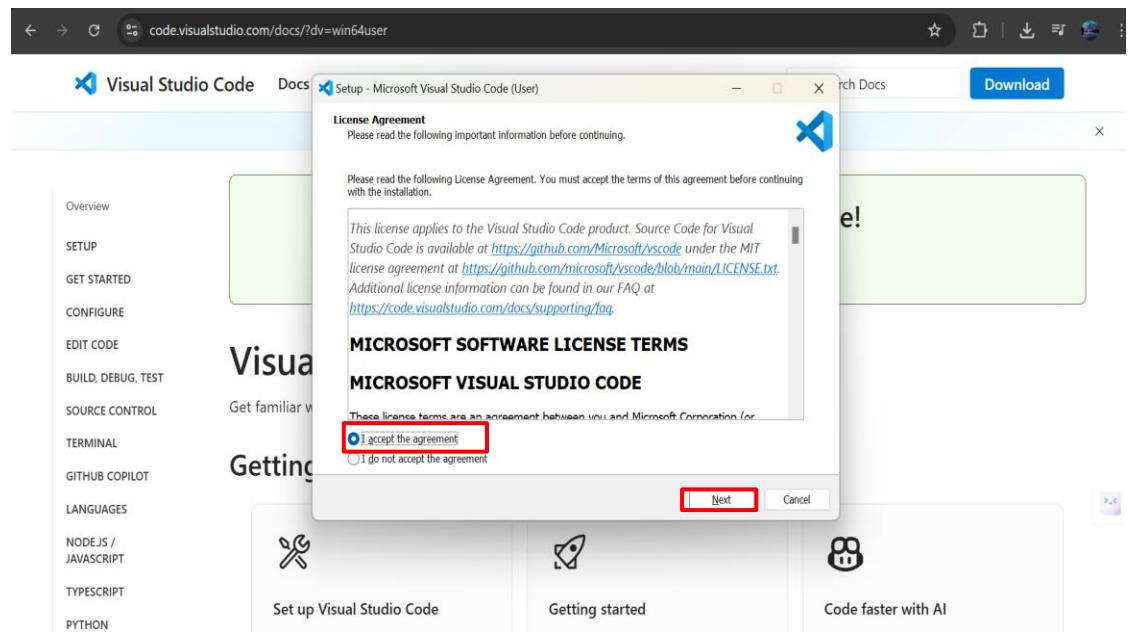
**Step 1:** Go to <https://code.visualstudio.com/>. Then click on Download for Windows if you are using Windows Operating System.



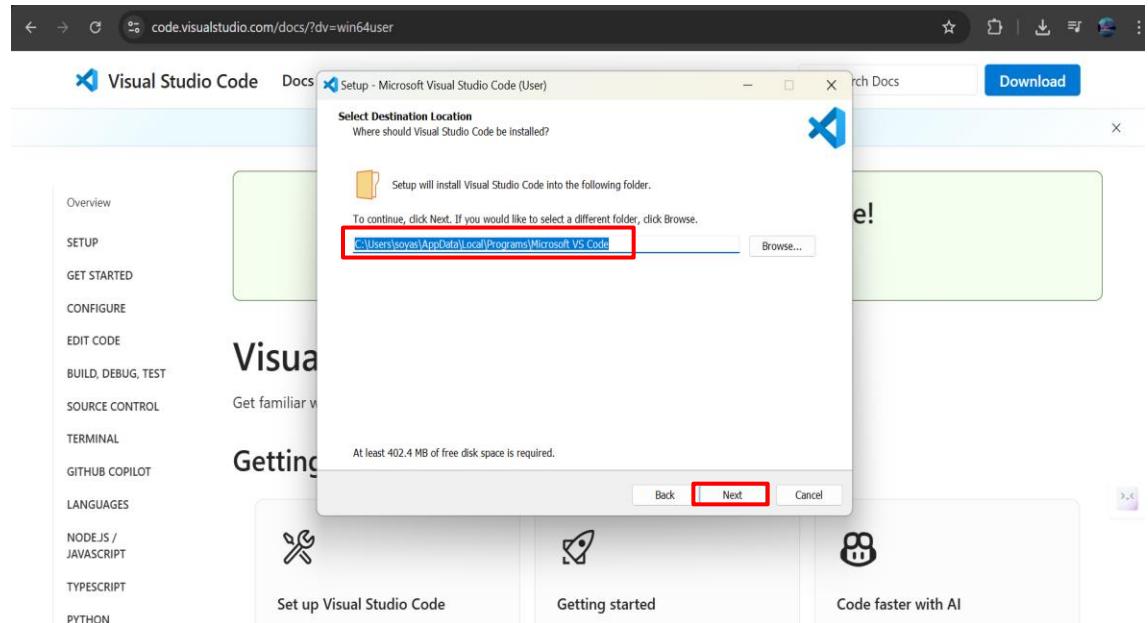
**Step 2:** The setup file should be downloaded as shown in the picture below, which when clicked should start the installation process of VS code.



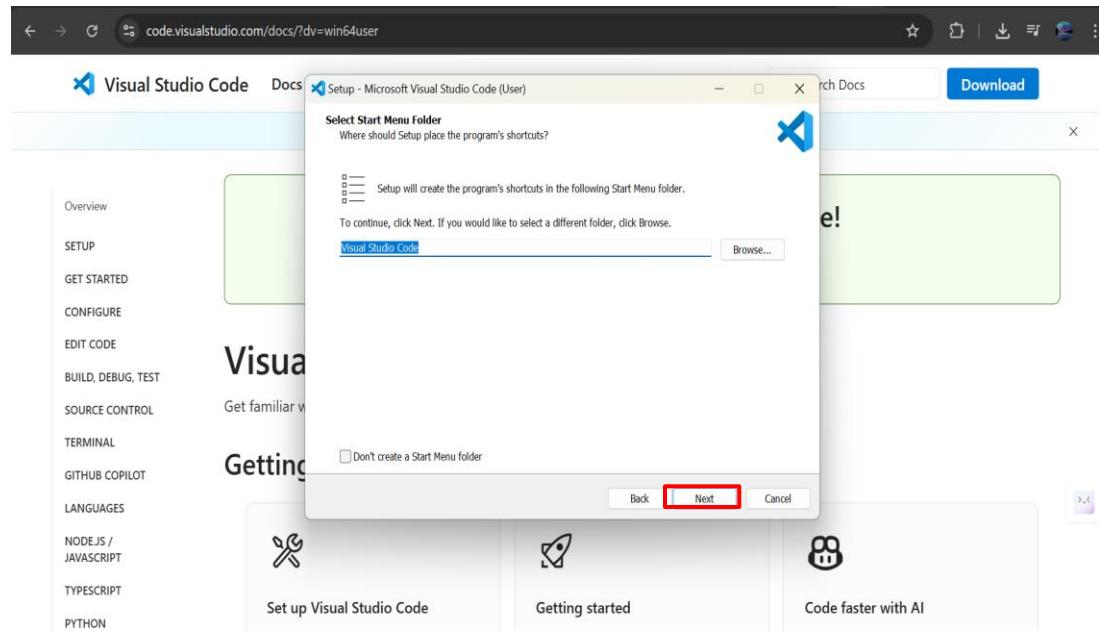
**Step 3:** Now click on “I accept the agreement” radio button and then on Next button to continue.



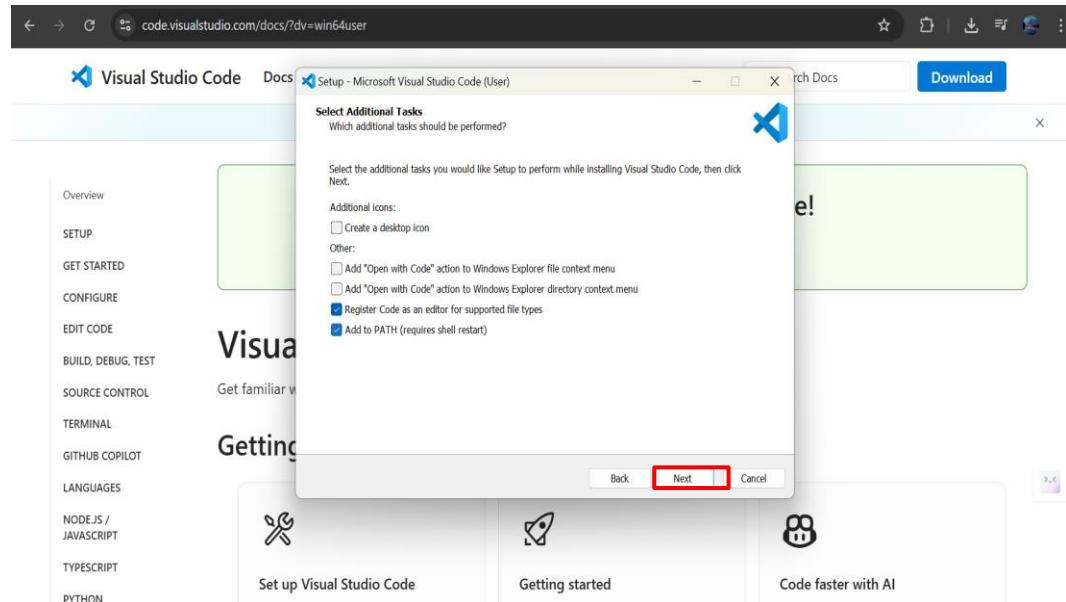
**Step 4:** To continue, Click on Next button or select the file destination according to your desire and then click on Next button.



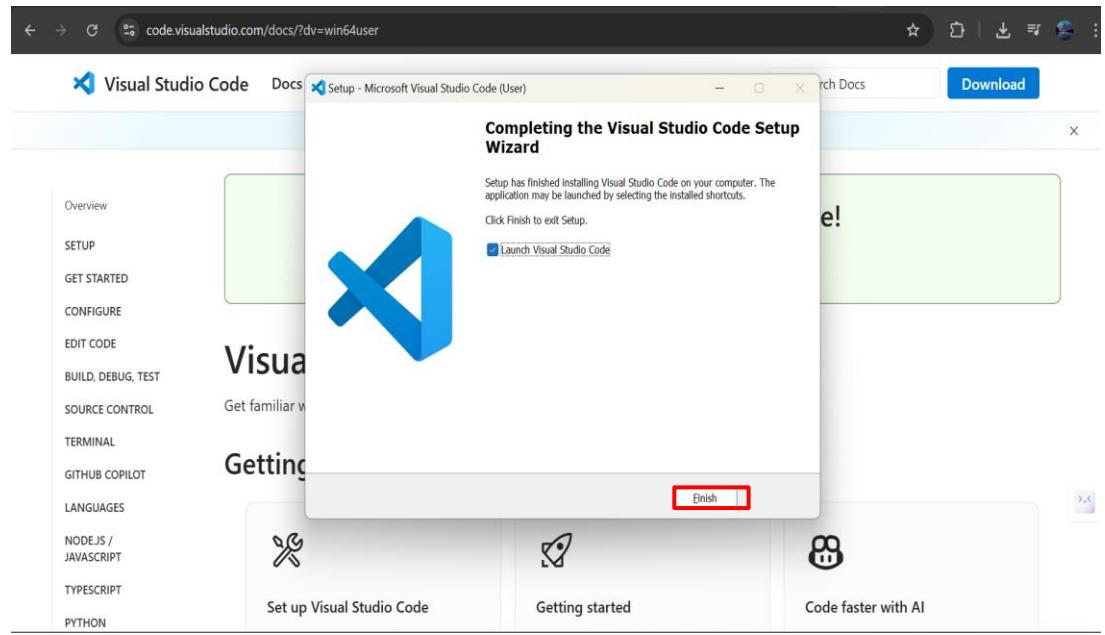
**Step 5:** Click on the Next button to continue the process.



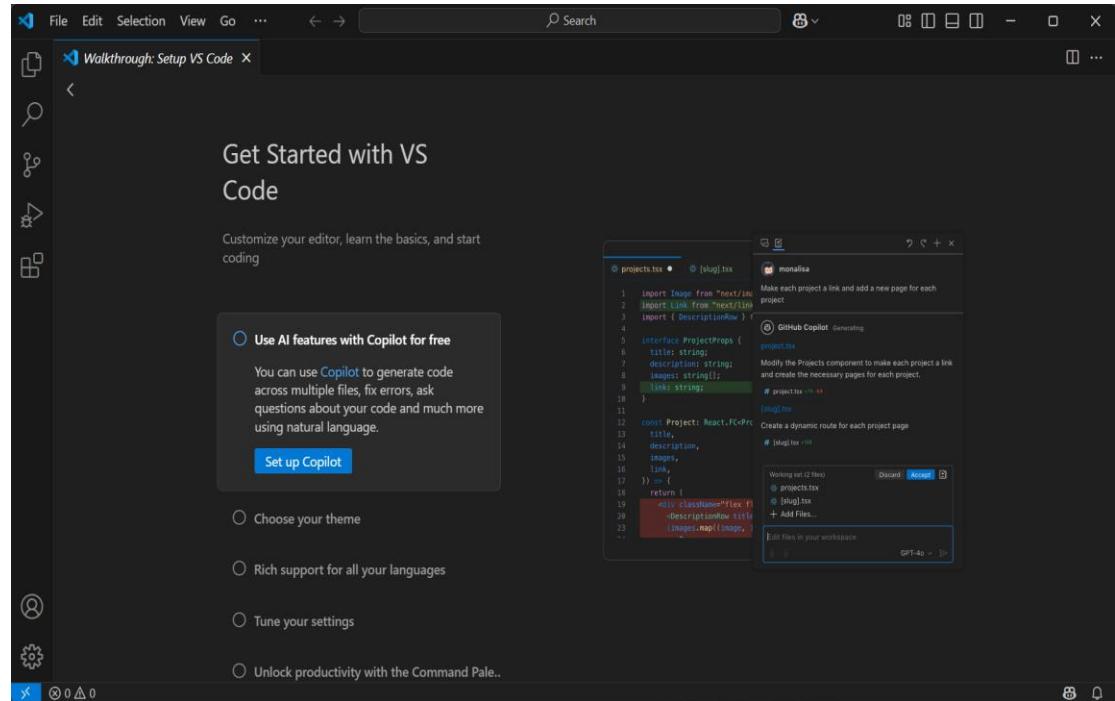
**Step 6:** Leave the default selection or select the additional tasks and then click on Next button.



**Step 7:** The setup for Visual Studio is now completed, click on the Finish button to get started with VS code.



**Step 8:** After clicking on the finish button, VS code is successfully installed. BY clicking on file -> new file, you can start with the coding in the VS code.



## 9.10 Use Case Diagram

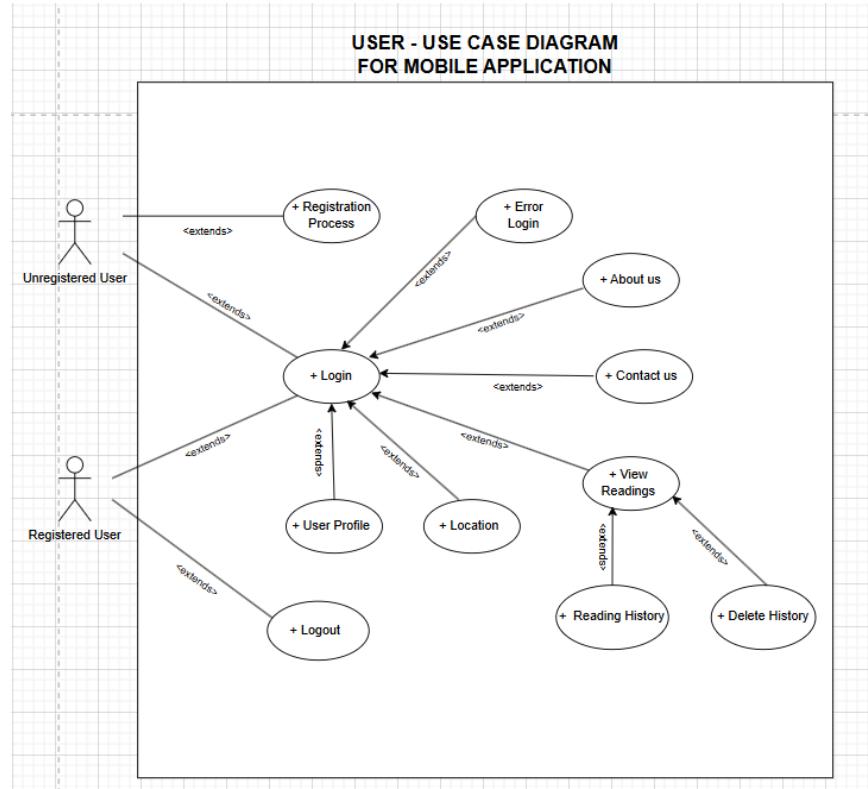


Figure 38: User Use Case Diagram for Smart Vitals (1)

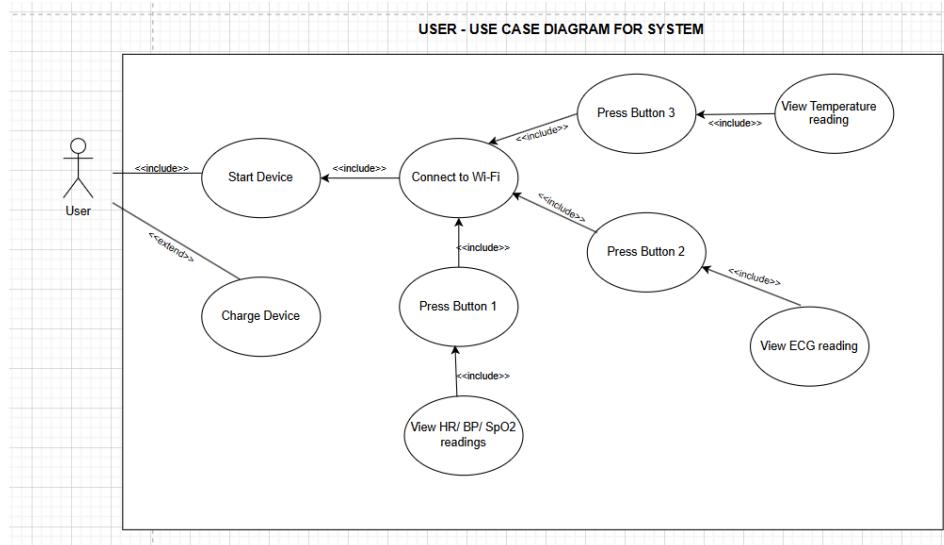


Figure 39: User Use Case Diagram for Smart Vitals (2)

The above use case diagram represents how users are associated with the Smart Vitals system and mobile application giving a perspective of the operations inside the system boundary.

## 9.11 Circuit Diagram

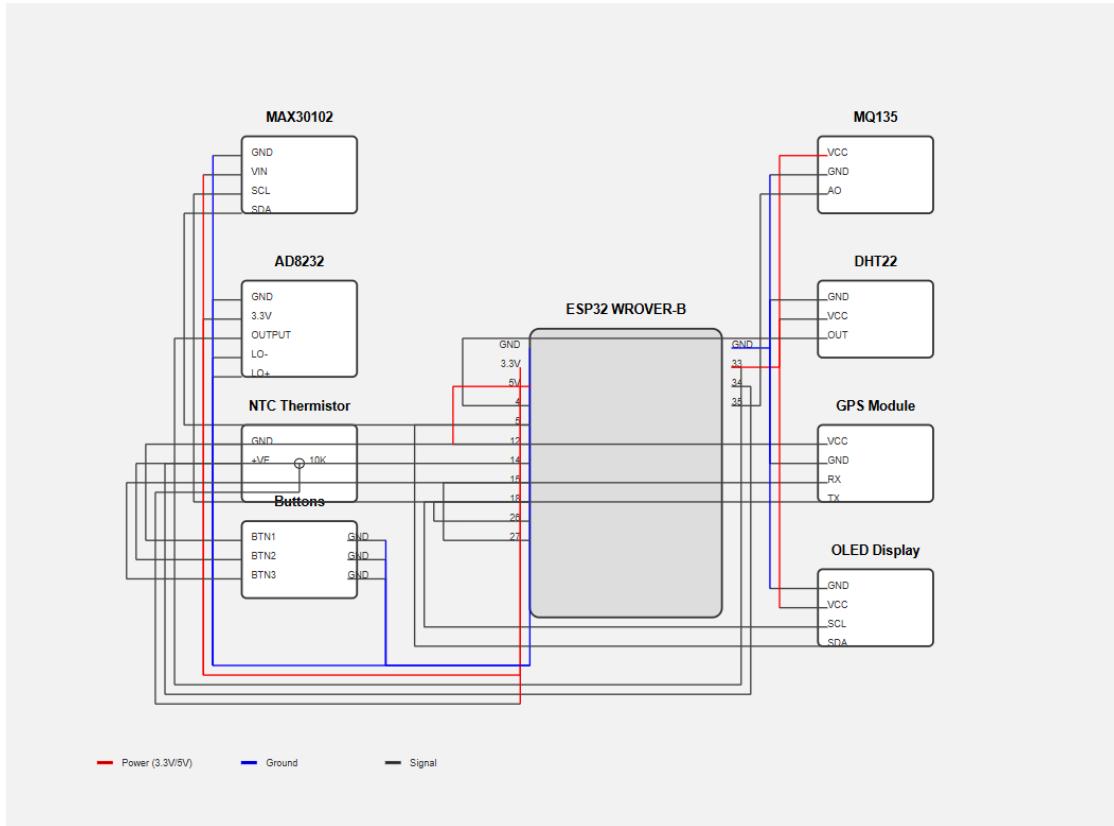


Figure 40: Circuit Diagram for Smart Vitals

The above circuit diagram represents how each component is associated with the micro controller (ESP 32 Wrover Type B). The positive power supply is represented by the red color wire connections; blue is represented by ground wire (negative power supply) similarly black wire connection is the signal or output connection.

## CHAPTER 10: SUMMARY AND CONCLUSION

Smart Vitals was developed to help people get insights on their health conditions. The main focus of the project was on improving health management and easy accessibility to the vitals. It is portable vitals monitoring system that helps users to measure their vitals. The device was designed in such a way that the users can easily get their required measurements with the integration of buttons. If there is a stable internet connection the measurements can be accessible via mobile app however OLED has been included in the system for local access, making it easy and quick to gain readings of the vitals. Voice alert has been added to the mobile app making it a smart feature with live location of the device for helping the users to take instant action. As an additional feature for Smart Vitals, air quality and temperature monitoring has been added to get insights on the environment conditions. The app allows users to save the vital readings according to their need, which could be necessary for further examination allowing the doctors or caretakers to keep track and gain knowledge on their past health history. While testing the product, all the necessary and important features were found to be decent. After doing several testing it was found that the Temperature, using 10k NTC thermistor thermometer and SpO2 using MAX30102 was 99% accurate. While Heart rate, using MAX30102 was 95% accurate. Similarly, the blood pressure was 97% accurate. Further experiments were conducted to test the alert feature; it was found that voice alert was working just fine. Overall, the device performed fair enough, making it a viable product for commercial market on further research and development.

There are many existing products in the market that are somewhat similar to Smart Vitals, while it is still a work in progress device, it has some features that stands out. As per (Valiaugaitė, 2025), Withings BeamO is a portable 4 in 1 device that measures the temperature, blood oxygen level, heart activities and respiratory system. While BeamO is device specifically designed for user health monitoring, Smart Vitals not only measures users' vitals but also the environments conditions like air quality and temperature. The device is integrated with GPS module so that user can easily get access to the location in case of

emergency, with stable Wi-Fi connection. Smart Vitals can give users an estimated measurement for blood pressure while BeamO lacks the feature.

BeamO is a high-end premium product which costs around \$249.95 according to (Bouchard, 2024), which might not be economical device for the users who are looking for cost effective device, however smartvitals on the other hand is cost effective providing users with more affordable solution. SmartVitals is still a prototype device, additional sensors could be added for more health readings, whereas BeamO is fully developed product thus, additions of more sensors are hardly possible.

Smart Vitals is an example of outcome of technology and health together making it a prototype device for promoting those sectors. Since it is just at a development stage i.e. a work in progress model it could be made into a market-oriented product using more advance and top-tier sensors. To take Smart Vitals to that level several changes could be made. Inclusion of additional sensors such as Blood Glucose Sensor, Electromyography, Stress Level Sensors, etc. could be added for additional vital monitoring. Additionally, further advanced analysis of ECG could potentially be a good additional to the device. Besides that, in the device battery could be further optimized for enhanced battery life. Smart Vitals does have voice alert, but inclusion of real-time alert with notification could be helpful for users to gain knowledge on the users' irregularities on health vitals. While smartvitals has an accuracy rate of around 96%, it could be improved with the usage of different sensors, more in-depth study and proper calibrations. The usage of AI in the system would be a great way to continue the smart vital project in future as it would help users to predict the health conditions and analyze vital trends. As of now Smart Vitals operates only on English language, which could be upgraded where it supports multiple language according to user preference, allowing easy interaction with the device as well as the mobile application. Integration of multiple language in Smart Vitals could be the future enhancement ideas. While these are few examples of how smart vitals can be upgraded in the future, there are many other ways to enhance the system making it compatible with other exiting products in the market.

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## APPENDIX

### Ethical Approval Form

#### Stage One

STAGE 1 - RESEARCH ETHICS APPROVAL FORM (from December 2016)



#### STAGE 1 - RESEARCH ETHICS APPROVAL FORM

Research by students and staff at the University must receive ethical approval before any data collection commences. Applications may be made on the Research Ethics Online system or via approval forms.

If using the approval forms, applicants complete this Stage 1 - Research Ethics Approval Form which includes the Risk Checklist.

For student projects classified as Risk Category 1 (e.g., many literature reviews), these can be approved on this Stage 1 – Research Ethics Approval Form by the Research Supervisor.

Applicants whose research studies are classified as Risk Category 2 or 3 must also complete and submit the separate Stage 2 - Research Ethics Approval Form.

Guidance for completion of this form and the application process is provided on pages 3 and 4.

APPLICANT DETAILS	
Your name (if a group project, include all names)	Soya Shrestha
School	The British College
STATUS	
• Undergraduate student	<input checked="" type="checkbox"/>
• Taught Postgraduate student	<input type="checkbox"/>
• Research Postgraduate student	<input type="checkbox"/>
• Staff member	<input type="checkbox"/>
• Other (give details)	
IF THIS IS A STUDENT PROJECT	
• Student ID	77356846
• Course title (eg, BA (Hons) History)	BSc. Hons Computing
• Student email	ssoya22@tbc.edu.np
• Research Supervisor's name Or Director of Studies' name	Rohit Raj Pandey
THE PROJECT/STUDY	
Project /study title	Smart Vitals: A portable Health Monitoring System
Start date of project	17 <sup>th</sup> December, 2024
Expected completion date of project	12 <sup>th</sup> May, 2025
Project summary – please give a brief summary of your study (maximum 100 words)	
<p>Smart Vitals is a portable health monitoring device designed to measure essential vital signs such as heart rate, SpO<sub>2</sub> (oxygen saturation), ECG, blood pressure, and body temperature in real-time.</p> <p>The system uses the ESP32 microcontroller, with sensors like the MAX30100 (SpO<sub>2</sub> &amp; heart rate), AD8232 (ECG sensor), and a temperature sensor. Collected data is displayed on the OLED screen for quick local access and transmitted via Wi-Fi to the mobile app, which offers a graphical representation of vitals. The app also enables the users to receive real-time alerts when abnormal readings are detected, ensuring timely medical interventions.</p>	
CONFIRMATION STATEMENTS	
<p>The results of research should benefit society directly or by generally improving knowledge and understanding. Please tick this box to confirm that your research study has a potential benefit. If you cannot identify a benefit you must discuss your project with your Research Supervisor to help identify one or adapt your proposal so the study will have an identifiable benefit.</p>	

<b>Please tick this box to confirm you have read the Research Ethics Policy and the relevant sections of the Research Ethics Procedures and will adhere to these in the conduct of this project.</b>	<input checked="" type="checkbox"/>
--	-------------------------------------

<b>RISK CHECKLIST - Please answer ALL the questions in each of the sections below – tick YES or NO</b>		<b>YES</b>	<b>NO</b>
<b>WILL YOUR RESEARCH STUDY.....?</b>			
1	Involve direct and/or indirect contact with human participants?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Involve analysis of pre-existing data which contains personal or sensitive information not in the public domain?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3	Require permission or consent to conduct?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Require permission or consent to publish?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	Have a risk of compromising confidentiality?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6	Have a risk of compromising anonymity?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7	Collect / contain sensitive personal data?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8	Contain elements which you OR your supervisor are NOT trained to conduct?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
9	Use any information OTHER than that which is freely available in the public domain?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
10	Involve respondents to the internet or other visual/vocal methods where participants may be identified?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
11	Include a financial incentive to participate in the research?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
12	Involve your own students, colleagues or employees?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
13	Take place outside of the country where you are enrolled as a student, or for staff, outside of the UK?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
14	Involve participants who are particularly vulnerable or at risk?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
15	Involve any participants who are unable to give informed consent?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
16	Involve data collection taking place BEFORE informed consent is given?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
17	Involve any deliberate deception or covert data collection?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
18	Involve a risk to the researcher or participants beyond that experienced in everyday life?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
19	Cause (or could cause) physical or psychological harm or negative consequences?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
20	Use intrusive or invasive procedures?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
21	Involve a clinical trial?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
22	Involve the possibility of incidental findings related to health status?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
23	Fit into any of the following security-sensitive categories: concerns terrorist or extreme groups; commissioned by the military; commissioned under an EU security call; involves the acquisition of security clearances? If yes, see the guidance.	<input type="checkbox"/>	<input checked="" type="checkbox"/>

<b>CLASSIFICATION</b> <b>The following guidance will help classify the risk level of your study</b>	<b>Tick the box which applies to your project</b>
If you answered <b>NO</b> to all the above questions, your study is provisionally classified as <b>Risk Category 1</b> (literature reviews will be Risk Category 1).	<input type="checkbox"/>
If you answered <b>YES</b> to any question from 1-13 and <b>NO</b> to all questions 14-22, your study is provisionally classified as <b>Risk Category 2</b> .	<input checked="" type="checkbox"/>
If you answered <b>YES</b> to any question from 14-22, your study is provisionally classified as <b>Risk Category 3</b> .	<input type="checkbox"/>
If question 23 has been answered <b>YES</b> , your application will be reviewed by the Chair of the University Research Ethics Sub-committee	<input type="checkbox"/>

DECLARATION AND SIGNATURE/S			
<p><i>I confirm that I will undertake this project as detailed above. I understand that I must abide by the terms of the approval and that I may not make any substantial amendments to the project without further approval.</i></p>			
Signed		Date	28 <sup>th</sup> February

FOR RISK CATEGORY 1 STUDENT PROJECTS					
<p><b>Approval from the Research Supervisor or Director of Studies for a student project:</b>  <i>I have discussed the ethical issues arising from the project with the student. I approve this project.</i></p>					
Name	Rohit Raj Pandey	Signed		Date	2 <sup>nd</sup> March

NEXT STEP					
<p><b>RISK CATEGORY 1 PROJECTS:</b> IF YOUR PROJECT HAS BEEN CLASSIFIED AS RISK CATEGORY 1:</p> <ul style="list-style-type: none"> <li>Students: The Research Supervisor should return the signed form to the student and send a copy to the Local Research Ethics Co-ordinator and where relevant, the Research Module Leader, for information.</li> <li>Staff: Submit this form to your Local Research Ethics Co-ordinator.</li> </ul> <p><b>RISK CATEGORY 2 OR 3 PROJECTS:</b> IF YOUR PROJECT HAS BEEN CLASSIFIED AS RISK CATEGORY 2 OR 3 please complete the <u><a href="#">Stage 2 - Research Ethics Approval form</a></u> and submit both forms together with supporting documentation.</p> <p><b>QUESTION 23:</b> If this question has been answered YES, your application will be reviewed by the Chair of the University Research Ethics Sub-committee, and the forms should be submitted directly to Professor Karl Spracklen, <a href="mailto:k.spracklen@leedsbeckett.ac.uk">k.spracklen@leedsbeckett.ac.uk</a>. You will need to submit the Security-sensitive research form available from the Research Ethics web page.</p> <p style="text-align: center;"><i>Research ethics application forms will be retained in the School for the purposes of quality assurance of compliance and audit for THREE years</i></p>					

#### NOTES FOR COMPLETION

*University Research Ethics Policy and Procedures:* The University Research Ethics Policy and Research Ethics Procedures should be read prior to commencing this application. Consideration of the application by the reviewer/s will be undertaken in accordance with the Policy and Procedures.

*External requirements for the project:* Applicants should consider if there are requirements by any relevant professional, statutory or regulatory body, or learned society, which may be relevant to the project or if the project also requires external approval.

#### Submission

- Student applicants: email the typed form/s to your Research Supervisor or Director of Studies.
- Staff applicants: email the typed form/s to your Local Research Ethics Co-ordinator.

#### How to complete the form

You can navigate through the form by using the tab keys. If you prefer to complete a normal Word document, you can unlock the form by selecting the 'Restrict Editing' button on the Developer tab, then click on 'Stop Protection'. The boxes should expand to allow space for your text.

#### **Signatures**

Electronic/typed signatures are acceptable for emailed forms, as the emails provide the audit trail for all parties' agreement and approval of the forms (e.g., student applicant → Research Supervisor → Local Research Ethics Co-ordinator).

#### **Outcome**

Applicants will be advised of the outcome of the application by receipt of the signed form from:

- The Research Supervisor or Director of Studies for Risk Category 1 student projects;
- The Local Research Ethics Co-ordinator or the School level group for Risk Category 2 and 3 projects.

YOU MAY ONLY BEGIN ANY DATA COLLECTION ONCE YOU RECEIVE NOTIFICATION THAT THE PROJECT HAS ETHICAL APPROVAL. If the circumstances of your research study change after approval it is your responsibility to revisit the Risk Checklist and complete a further application.

#### **Advice**

When completing the Stage 1 - Research Ethics Approval Form, if you are uncertain about the answer to any question, read the relevant section of the Research Ethics Procedures document, and if you are still unsure:

- if you are student, seek guidance from your Research Supervisor or Director of Studies;
- if you are a staff member, contact your Local Research Ethics Co-ordinator.

## APPROVAL PROCESS

- Local Research Ethics Co-ordinator = LREC
- School level group (if your School uses a different review process, please follow your School guidance)
- University Research Ethics Sub-Committee = URESC

Category	Student applicants	Staff applicants
Risk Category 1	<p>If your study has been provisionally classified as Risk Category 1, your Research Supervisor (or Director of Studies) can normally give approval for the project.</p> <p>You must complete this form and submit it to your Research Supervisor for consideration.</p> <p>A copy of the signed form if approved must be given or emailed to the LREC and, where relevant, the Research Module Leader, for information.</p>	<p>If your study has been classified as Risk Category 1, you do not need ethical approval for the project.</p> <p>You must complete the remainder of this form so that your research project is registered with the University.</p> <p>Please submit this form to your LREC.</p>
Risk Category 2	<p>If your study has been provisionally classified as Risk Category 2, your Supervisor (or Director of Studies) can recommend approval for your study by the LREC.</p> <p>You must complete this application form and also the separate <u>Stage 2 - Research Ethics Approval form</u>.</p> <p>Once you have completed the forms please submit both forms and supporting documentation to your Research Supervisor for consideration. Your Supervisor may disagree with your assessment and ask you to make revisions or reject your application. When the Research Supervisor is happy to recommend the application for approval, they will send the forms to the LREC.</p> <p>The LREC will review your project and then decide to approve it, ask for revisions, reject it or pass it on for review by the School level group.</p>	<p>If your study has been provisionally classified as Risk Category 2, your project will be considered for ethical approval by the LREC.</p> <p>You must complete this application form and also the separate <u>Stage 2 - Research Ethics Approval form</u>. Please submit both forms and supporting documentation to your LREC for consideration.</p> <p>The LREC will review your project and then decide to approve it, ask for revisions or pass it on for review by the School level group.</p>
Risk Category 3	<p><b>Postgraduate Research Students</b></p> <p>If your study has been provisionally classified as Risk Category 3, your Supervisor or Director of Studies can recommend approval for your study by the LREC.</p> <p>You must complete this application form and also the separate <u>Stage 2 - Research Ethics Approval form</u> and submit both forms to your Director of Studies.</p> <p>If your Director of Studies recommends approval of your project they will refer it to the LREC who will review your project and decide whether to grant ethical approval, request revisions, reject the application or refer it to the School level group for review.</p> <p><b>Undergraduate and Taught Postgraduate Students</b></p> <p>If your study has been provisionally classified as Risk Category 3, you should consult with your Research Supervisor immediately as it is unlikely you will be able to proceed and you should negotiate a project that is of lower risk. However, if you have already discussed the project with your Supervisor and they have agreed that a case for approval is warranted, proceed in line with the details above for Research Students.</p>	<p>If your study has been provisionally classified as Risk Category 3, your project will be considered for ethical approval by an appropriate LREC.</p> <p>You must complete this application form and also the separate <u>Stage 2 - Research Ethics Approval form</u> and submit both forms with supporting documentation to your LREC.</p> <p>The LREC will review your project and then decide to approve it, ask for revisions or pass it on for review by the School level group.</p>
Q23	If question 23 has been answered 'yes', your application will be reviewed by the Chair of the University Research Ethics Sub-committee. The answer does not affect the Risk Category.	

## Stage Two

STAGE 2 - RESEARCH ETHICS APPROVAL FORM (December 2016)



### STAGE 2 - RESEARCH ETHICS APPROVAL FORM

All research carried out by students and staff at the University must receive ethical approval before any data collection commences.

#### Notes

- Applicants complete the Risk Checklist and Stage 1 - Research Ethics Approval Form prior to completing this Stage 2 - Research Ethics Approval Form. Following completion of the Risk Checklist and Stage 1 - Research Ethics Approval Form, if your research study was provisionally classified as Risk Category 2 or 3, you need to complete this form.
- Full details of the project are to be provided in this Stage 2. Where a question in the Risk Checklist was answered YES, please ensure that specific details are included in the appropriate box below.
- If a question does not apply to your project, insert 'Not applicable' or N/A.
- Help is provided for each question. Further help can be found in the Research Ethics Procedures document.
- You navigate through the form by using the tab keys. If you prefer to complete a normal Word document, you can unlock the form by selecting the 'Restrict Editing' button on the Developer tab, then click on 'Stop Protection'. The boxes should expand to allow space for your text.
- Spellchecking is not available in Word forms, so you may find it helpful to prepare your responses in a Word document and then copy these to this form.
- Ensure the form is completed in sufficient detail to allow the reviewer to judge the ethical issues raised by the study. Remember that the reviewer will be considering the following questions when reviewing your application in order to be able to give ethical approval:
  - is it ethical to conduct the research project and is the proposed method of investigation appropriate, thorough and ethical?
  - does the research project meet the requirements of the relevant Research Ethics Principles (Research Ethics Policy A2.4)?

TO BE COMPLETED FOR PROJECTS IN RISK CATEGORY 2 AND 3	
Your name	Soya Shrestha
Project title	Smart Vitals: A Portable Health Monitoring System

1	Project Overview
<p>Please give a brief overview of your study, including a summary of your aims and objectives. Help: Describe the purpose of the research and what question(s) the project should answer.</p>	
<p>The Smart Vitals: A Portable Health Monitoring System project aims to design and develop a portable, IoT-based health monitoring device capable of tracking key vital signs, including heart rate, SpO<sub>2</sub> (oxygen saturation), ECG, blood pressure, and body temperature. The system will provide users with real-time access to their health data through an OLED display for immediate feedback, as well as a mobile application for remote monitoring. By integrating advanced sensors such as the MAX30102 for SpO<sub>2</sub> and heart rate, the AD8232 for ECG, and a temperature sensor, the device will ensure accurate and timely readings.</p> <p>The primary objective of this project is to offer an accessible, reliable, and portable solution for ongoing health monitoring, making it easier for individuals to track their vital signs and detect potential health issues early. With the added capability of real-time alerts sent through the mobile app, caregivers and users will be notified of abnormal readings, ensuring that timely interventions can be made when necessary.</p>	

Ultimately, the project aims to assess the effectiveness of an IoT-driven, portable health monitoring system in providing continuous health insights and enabling proactive healthcare management, especially in situations where immediate medical attention is needed.

2	<b>Methodology</b>
<p><b>Please give a description of your methodology, including any data collection and analysis methods.</b></p> <p><u>Help:</u> Give an outline of your study here. If the project is complex, you can also submit your research proposal/protocol (no more than 2-3 A4 sides) if this would help the reviewer's understanding of the project. Include details of your (or your Research Supervisor's) appropriate skills and qualifications to carry out this research.</p> <p>SpO<sub>2</sub> sensors, ECG sensors, temperature sensors, and Arduino board, are selected based on their performance and precision. The sensors are embedded in Arduino and evaluated for different measurements, for real-time access including OLED display with graphics. Real time health readings are provided to the users through a flutter-based mobile application whenever any irregularities are detected. It also provides data security through an encrypted communication system ensuring the users' privacy.</p> <p>The sensors' reliability and precision would be validated by contrasting the readings with the medical devices. The project would implement Agile methodology, by dividing the development process into iterative phases, focusing on particular milestones, including sensor configuration and mobile app development. In order to track the progress, Gnatt chart and Timeline would be used.</p>	

3	<b>Main Ethical Considerations</b>
<p><b>Please give a brief description of the main ethical considerations involved in the study.</b></p> <p><u>Help:</u> All research projects will have ethical issues, and you will be asked later in the process on recruitment, voluntary participation and the right to withdraw, but highlight here the main ethical considerations for your study (which may concern, e.g., the type of participants, the sensitive nature of the study, the data collection process, a lone researcher carrying out research off-campus, security-sensitive research) and advise how you will address the main issues. If the project is funded, give details here, and whether there are any potential conflicts of interest involved in the study.</p> <p>The main ethical considerations for the Smart Vitals project include ensuring the privacy and confidentiality of participants' health data, obtaining informed consent, and ensuring voluntary participation with the right to withdraw. Data will be anonymized, securely stored, and accessible only to authorized personnel. Participants will be fully informed about data collection, storage, and potential risks. The research will be conducted within the personal premises of the participants. The project is self-funded, not involving any external financial aid or conflicts of interest involved in the study.</p>	

4	<b>Human Participants</b>
<p><b>If your study includes Human Participants (or their data), please give a description of who will be included.</b></p> <p><u>Help:</u></p> <ul style="list-style-type: none"> <li>• Please note this should include sample size/number of participants, whether the project will focus on any particular groups/individuals, if it will include any at risk or vulnerable participants, participants aged 16 years or under, etc. Please also specify your rationale for including / excluding groups of participants.</li> <li>• If the research involves secondary data not in the public domain, give details in this section.</li> </ul> <p>For my project, Smart Vitals, it is essential to have human participants for testing phase, which will allow me to get more precise health data. I do not intend to include a huge number of participants as I will be doing most of the testing within personal premises, possibly after performing various activities to ensure that the readings from my sensors are able to get accurate data in various conditions. So, I will be including participants no more than 5.</p> <p>No at-risk or vulnerable participants, including those under 16, will be involved in this study to avoid ethical and safety concerns. The inclusion criteria focus on adults who can provide informed consent and actively participate in device testing.</p> <p>This research does not involve the use of any secondary data that is not in the public domain. All data collected will be primary, gathered directly from participants through the Smart Vitals health monitoring device during testing. Data will be used solely for the purpose of evaluating the device's accuracy and performance and will be handled with strict confidentiality and security measures.</p>	

5	<b>Recruitment, Voluntary Participation, Consent and Right to Withdraw</b>
<p><b>If your study includes Human Participants, please give a brief description of the recruitment process, how you will ensure voluntary participation, if (and how) informed consent will be obtained prior to participants taking part in the study, and the right of withdrawal from the research process.</b></p> <p><u>Help:</u></p> <ul style="list-style-type: none"> <li>• This should include clear information on how participants will be identified, approached and recruited; whether the study will include any covert research or deliberate deception; whether help is required from a third party/ gatekeeper to access participants; what information you will give participants, etc.</li> <li>• If expenses or any incentives are to be offered to participants, give full details.</li> <li>• If your research involves students, colleagues and/or other employees then you must specify the rationale for this and how you will address issues of coercion or feelings of obligation.</li> <li>• Regarding withdrawal from the study, discuss the different stages/dates a participant could withdraw or withdraw their data, and how they could do this.</li> </ul> <p>Participants will be recruited voluntarily where the project's risks, benefits, scope and objectives will be clearly stated for the participants to make decision for research and testing. No third-party or gatekeeper involvement will be required for access to participants, with no expenses or any incentives are to be offered to participants.</p> <p>Participants will have the right to withdraw from the study at any stage without any obligation to provide a reason. They will also have the option to withdraw their data from the study up to a specified date before data analysis begins. If the participants want to withdrawal their data a prior email will be much appreciated, so that other participants can be involved.</p>	

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<b>6 Risks and Benefits</b>
<p><b>Please give a brief description of how, when and where the research will take place and whether there are any risks and/or benefits involved.</b></p> <p><u>Help:</u></p> <ul style="list-style-type: none"><li>• This should include information on what participants will be required to do, the rationale for this and the level of risk involved.</li><li>• When considering risks, please refer to risks to the participants (e.g., for research in sensitive areas), the researcher, any other parties to the research; and also any health and safety issues for anyone involved (e.g., for lone researchers carrying out fieldwork).</li><li>• If participants will be exposed to ionising radiation, separate approval documentation must be submitted with this application.</li></ul> <p>The testing will be held begin within different time phrase, primarily conducted within the participants premises, where the device can be safely tested. They will follow simple instructions, like placing their finger on the MAX30102 sensor, attaching ECG patches to the chest area, and positioning the temperature sensor on the body for accurate readings.</p> <p>There will be minimal risks involved, which may be due to slightly discomfort from the ECG patches. Proper placement instruction and care will be given to make sure such discomfort are minimal. There is no use of ionizing radiation or invasive procedures in this research.</p> <p>The benefit of this research will be result in the development of a portable health monitoring device that can provide real-time data and timely alerts for medical interventions. This can be useful to individuals to manage health conditions. It reduces the need for frequent hospital visits and costly medical checkups by enabling users to monitor their vital signs conveniently from home.</p> <p>Additionally, this portable device is especially beneficial for adventure enthusiasts, travellers, and outdoor lovers who may not always have easy access to medical facilities, ensuring they can keep track of their health status.</p>

<b>7 Personal Data, Anonymity and Confidentiality</b>
<p><b>Please specify what type of information/data will be collected/analysed and the source(s). In addition, specify if and how you will ensure the anonymity of participants and keep information confidential.</b></p> <p><u>Help:</u> This should include information on whether you are collecting new information/data or using that is already in the public domain; whether the data you are using includes personal details; how the data will be processed and stored; who will have access to it; how and when it will be destroyed; the Data Protection requirements for any sensitive personal data, etc. In addition, include whether there may be any requirements for disclosure of information to other parties due to professional practice or legal reasons. If there are limits to confidentiality, explain clearly how the participants would be advised about these limits and possible outcomes.</p> <p>The Smart Vitals: A Portable Health Monitoring System project will collect personal health data such as heart rate, SpO<sub>2</sub> levels, blood pressure, and body temperature. This data will be securely stored via</p>

encryption and accessible only by authorized personnel (researchers). Anonymity will be maintained and data will be processed locally, all the logs will be deleted after the completion of the project. Participants will be informed about any limitations to confidentiality.

**8 Reporting and Dissemination**

**Please give details of the planned dissemination and specify if the findings from the research will be published and whether any permission is required for this.**

Help: This should include information on the methods of dissemination (e.g., dissertation/thesis) and/or what will be published and where (research papers, conference presentations). Specify if any permission is needed (e.g., from participants, clients, gatekeepers, etc.) prior to publication, and whether there are any potential issues relating to Intellectual Property Rights when creating or using materials.

The findings from this research will be primarily disseminated through the final report submitted to The British College as part of the BSc Computing degree Production Project module.

As of now, I have no intention of publishing the finding of the research. If I were to publish the project, permission will be obtained from participants to use their anonymized data, ensuring confidentiality and ethical standards are maintained. No external permissions from gatekeepers are needed, and there are no known issues related to Intellectual Property Rights, as all materials and designs for the Smart Vitals system are original or openly accessible.

**9 Location of research**

**Will the research take place outside of the country where you are enrolled as a student, or for staff, outside of the UK?**

YES  NO  If yes, give details below.

Help: If yes, please specify where the research will take place and what will be involved. Research must comply with the laws of the country where it is taking place and also comply with local Data Protection and Intellectual Property legislation: you must confirm that your research is compliant with local requirements and how you have ascertained this. Advise if the project requires ethical approval in-country and how this has been ascertained. If approval is required, a copy of this should be included in the application or details of the process of how it will be obtained. Please make reference to insurance and indemnity cover for the project where relevant.

N/A

**10 Collaborative Projects**

**Is the research a collaborative project (i.e., it involves more than one institution)?**

YES  NO  If yes, give details below.

**Help:** If yes, please specify the other institutions involved and if ethical approval needs to be / has been given by them. Please also specify what procedures have been put in place to ensure ethical compliance from all partners.

N/A

**11 Any other permission or external ethical approval required to undertake the project**

Please specify if the project requires any other ethical approval or permissions not mentioned previously in this application and how and when these will be obtained.

**Help:**

- Other permissions: ethical approval does not give the right of access to the University's students, staff or the use of University premises to carry out research, and you may need to contact an appropriate University gatekeeper for agreement to approach potential participants or for the use of premises, so please give details.
- Gatekeepers: permission of a gatekeeper for initial access to participants may be required or to carry out data collection on their premises.
- If your project requires approval from an external ethics committee, this should normally be obtained prior to submitting this application.
- If a Disclosure and Barring Service check is required due to the specific participant group, give details.
- Regarding insurance and indemnity cover, some projects will require individual confirmation of cover. See the Research Ethics Procedures document for more details.

This project does not require any additional ethical approvals or permissions beyond what has been outlined in this application. The study will involve voluntary participation from individuals providing their health data through the Smart Vitals device, with informed consent obtained beforehand. No external ethics committee approval or gatekeeper permissions are necessary, as the data collection will not take place on third-party premises, nor will it involve at-risk or vulnerable groups. Additionally, no Disclosure and Barring Service check is required, and the project activities fall within the standard scope of ethical research practices.

**FOR PROJECTS INVOLVING RISK CATEGORY 2 AND 3: DECLARATION AND SIGNATURE/S**

**APPLICANT (STUDENT/STAFF MEMBER/RESEARCHER)**

*I confirm that I will undertake this project as detailed in stage one and stage two of the application. I understand that I must abide by the terms of this approval and that I may not make any substantial amendments to the project without further approval. I understand that research with human participants or their data must not commence without ethical approval.*

I have read an appropriate professional or learned society code of ethical practice:	Yes <input checked="" type="checkbox"/> N/A <input type="checkbox"/>
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Where applicable, give the name of the professional or learned society:	
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Signed		Date	28 <sup>th</sup> February
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RESEARCH SUPERVISOR/DIRECTOR OF STUDIES RECOMMENDATION FOR STUDENT PROJECTS					
<p>I confirm that I have read stage one and stage two of the application. The project is viable and the student has appropriate skills to undertake the project. Where applicable, the Participant Information Sheet and recruitment procedures for obtaining informed consent are appropriate and the ethical issues arising from the project have been addressed in the application. I understand that research with human participants must not commence without ethical approval. I recommend this project for approval.</p>					
Name	Rohit Raj Pandey	Signed		Date	2 <sup>nd</sup> March

#### Local Research Ethics Co-ordinators

Please complete **EITHER A** (giving ethical approval for the project) **OR B** (recommending the project to the School level group for approval)

<b>A</b>	LOCAL RESEARCH ETHICS CO-ORDINATOR APPROVAL <i>For projects approved by the Local Research Ethics Co-ordinator</i>				
I confirm ethical approval for this project					
LREC Name		Signed		Date	

**OR**

<b>B</b>	LOCAL RESEARCH ETHICS CO-ORDINATOR'S RECOMMENDATION FOR SCHOOL APPROVAL <i>For projects that require School level approval</i>				
I recommend this project for consideration at school level. It cannot be approved at local level due to the following reason(s)					
LREC Name		Signed		Date	

#### School level group

For projects approved at School level please complete the box below.

PROJECTS APPROVED BY THE SCHOOL LEVEL GROUP					
I confirm that this project was considered by the School level group and has received ethical approval					

<i>Group Lead</i>		<i>Signed</i>		<i>Date</i>	
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**OR**

**University Research Ethics Sub-Committee**

*For projects approved by URESC please complete the box below.*

*Projects involving security-sensitive research do not need supervisor/LREC approval prior to being considered by the Chair of URESC.*

<b>PROJECTS APPROVED BY THE RESEARCH ETHICS SUB-COMMITTEE</b>					
<i>I confirm that this project was considered by the Research Ethics Sub-committee and has received ethical approval</i>					
<i>Chair</i>		<i>Signed</i>		<i>Date</i>	

*This form will be retained for the purposes of quality assurance of compliance and audit for THREE years*

**SUPPORTING DOCUMENTATION: what to submit with the application**

For projects involving human participants, you must submit, where appropriate, the Participant Information Sheet/s and consent form/s. You must also submit every communication a participant will see or receive. Failure to do so will cause delays to the application.

Below is a checklist reminder of what could be submitted, depending on the research project. Please tick the appropriate boxes for each attachment or give details of the document at the end of the checklist.

SUBMISSION CHECKLIST	Tick box
RISK CHECKLIST AND STAGE 1 – RESEARCH ETHICS APPROVAL FORM	<input checked="" type="checkbox"/>
STAGE 2 – RESEARCH ETHICS APPROVAL FORM	<input checked="" type="checkbox"/>
Participant Information Sheet(s)	<input type="checkbox"/>
Consent Form(s)	<input type="checkbox"/>
Assent Form (usually for children participants)	<input type="checkbox"/>
Recruitment documents <i>eg, posters, flyers, advertisements, email invitations, letters, web pages if online research</i>	<input type="checkbox"/>
Measures to be used <i>eg, questionnaires, surveys, interview schedules, psychological tests</i>	<input type="checkbox"/>
Screening questionnaire	<input type="checkbox"/>
Letters/communications to and from gatekeepers/third parties	<input type="checkbox"/>
Evidence of any other approvals or permissions <i>eg, NHS research ethics approval, in-country approval</i>	<input type="checkbox"/>
Research proposal/protocol (no more than 2-3 A4 pages) <i>It is not a requirement that this is included, however, if this would help the understanding of a complex project by the reviewer(s), please include</i>	<input type="checkbox"/>
Risk assessment form <i>Some projects may require a risk assessment form: see the Procedures document for details (eg, projects involving a physical intervention, collecting data off-campus)</i>	<input type="checkbox"/>
Approval documentation for projects involving ionising radiation	<input type="checkbox"/>
Confirmation of insurance and indemnity cover where relevant <i>Some projects need to be referred to the Insurance &amp; Risk Officer: see the Procedures document</i>	<input type="checkbox"/>
Security-sensitive research form	<input type="checkbox"/>
Other: give details here:	<input type="checkbox"/>
	<input type="checkbox"/>

**SUBMITTING YOUR FORMS**

- Students: email the typed forms (stage one and stage two) and supporting documentation to your Research Supervisor or Director of Studies.
- Staff: email the typed forms (stage one and stage two) and supporting documentation to your Local Research Ethics Co-ordinator.
- Security-sensitive research: the stage one form (and stage two form if applicable) should be submitted directly to the URESC Chair, Professor Karl Spracklen, [k.spracklen@leedsbeckett.ac.uk](mailto:k.spracklen@leedsbeckett.ac.uk) and include the Security-sensitive research form, available from the Research Ethics web page.

**Meeting Records**

**Meeting 1:**

School of Computing, Creative Technologies and Engineering  
2024/25

## Level 6 Production Project

<b>MEETING RECORD SHEET:</b>		<b>Meeting Number:</b> <b>1</b>
<b>Student:</b> Soya Shrestha	<b>Student I.D.:</b> 77356846	
<b>Date of Meeting:</b> 24 <sup>th</sup> February 2025	<b>Supervisor:</b> Mr. Rohit Raj Pandey	
<b>Actions agreed at previous meeting (completed or comment):</b>		
1	A one-page report summarizing the project.	✓
2	A flow diagram outlining the process and structure of your project, from start to finish.	✓
<b>Comments of student (if any):</b> .....		
<i>ABOVE here – student to complete before Meeting with supervisor. BELOW here – complete at the Meeting.</i>		
<b>Next meeting</b> (date/time): 27 <sup>th</sup> February 2025		
<b>Agreed Actions to complete before next meeting:</b>		
1	Upload the project summary and data flow diagram in the drive provided by the supervisor.	
<b>Comments of supervisor (if any):</b> .....		
 <b>signature:</b>		

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**Meeting 2:**

**School of Computing, Creative Technologies and Engineering 2024/25**

## **Level 6 Production Project**

<b>MEETING RECORD SHEET:</b>	<b>Meeting Number: 2</b>
<b>Student: Soya Shrestha</b>	<b>Student I.D.: 77356846</b>
<b>Date of Meeting: 27<sup>th</sup> February 2025</b>	<b>Supervisor: Mr. Rohit Raj Pandey</b>

### **Actions agreed at previous meeting (completed or comment):**

- |          |  |
|----------|--|
| <b>1</b> | Uploaded the necessary submission file in the drive. ✓ |
|----------|--|

### **Comments of student (if any):**

.....

*ABOVE here – student to complete before Meeting with supervisor. BELOW here – complete at the Meeting.*

**Next meeting (date/time): 7<sup>th</sup> March 2025**

### **Agreed Actions to complete before next meeting:**

- |          |                                  |
|----------|----------------------------------|
| <b>1</b> | Ethical consent form discussion. |
|----------|----------------------------------|

2	
3	
4	
5	
6	

**Comments of supervisor (if any):**



**signature:**

Meeting 3:

School of Computing, Creative Technologies and Engineering 2024/25

## Level 6 Production Project

### MEETING RECORD SHEET:

Meeting  
Number: 3

**Student: Soya Shrestha**

**Student I.D.: 77356846**

**Date of Meeting: 7<sup>th</sup> March  
2025**

**Supervisor: Mr. Rohit Raj  
Pandey**

**Actions agreed at previous meeting (completed or comment):**

- |          |  |
|----------|--|
| <b>1</b> | Submission of ethical consent form stage one and two.✓ |
|----------|--|

**Comments of student (if any):**

.....

*ABOVE here – student to complete before Meeting with supervisor. BELOW here – complete at the Meeting.*

**Next meeting (date/time): 27<sup>th</sup> March 2025****Agreed Actions to complete before next meeting:**

- |          |  |
|----------|--|
| <b>1</b> | Progression of the project.            |
| <b>2</b> | Completion of Chapter 4 and Chapter 9. |

**Comments of supervisor (if any):**

.....



**signature:****Meeting 4:****School of Computing, Creative Technologies and Engineering 2024/25****Level 6 Production Project****MEETING RECORD SHEET:****Meeting  
Number: 4**

<b>Student: Soya Shrestha</b>	<b>Student I.D.: 77356846</b>
<b>Date of Meeting: 27<sup>th</sup> March 2025</b>	<b>Supervisor: Mr. Rohit Raj Pandey</b>
<b>Actions agreed at previous meeting (completed or comment):</b>	
<b>1</b>	Completed Chapter 4 and Chapter 9 of the report. ✓
<b>Comments of student (if any):</b>	
<p>.....</p> <p><i>ABOVE here – student to complete before Meeting with supervisor. BELOW here – complete at the Meeting.</i></p>	
<b>Next meeting (date/time): 15<sup>th</sup> April 2025</b>	
<b>Agreed Actions to complete before next meeting:</b>	
<b>1</b>	80% completion of the report and product for Work in Progress.
<b>Comments of supervisor (if any):</b>	
<p>.....</p>  <p><b>signature:</b></p>	

Meeting 5:

**School of Computing, Creative Technologies and Engineering 2024/25**

**Level 6 Production Project**

**MEETING RECORD SHEET:**

**Meeting  
Number: 5**

**Student: Soya Shrestha**      **Student I.D.: 77356846**

**Date of Meeting: 15<sup>th</sup> April  
2025**      **Supervisor: Mr. Rohit Raj  
Pandey**

**Actions agreed at previous meeting (completed or comment):**

- 1** Completed 80% of both product and report. ✓

**Comments of student (if any):**

.....  
*ABOVE here – student to complete before Meeting with supervisor. BELOW here – complete at the Meeting.*

**Next meeting (date/time):**

**Agreed Actions to complete before next meeting:**

- 1** Discussion on the features that could be added on the product.

**Comments of supervisor (if any):**

**signature:**

